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French Language Editor & Book Review Editor

RICHARD P. KORF
English Language Editor & Managing Editor

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MYCOTAXON

AN INTERNATIONAL JOURNAL DESIGNED TO EXPEDITE PUBLICATION
OF RESEARCH ON TAXONOMY & NOMENCLATURE OF FUNGI & LICHENS

Vol. I July-September 1974 No. 1

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MYCOTAXON

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MYCOTAXON, A NEW INTERNATIONAL JOURNAL ON TAXONOMY AND NOMENCLATURE OF FUNGI AND LICHENS

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The need for another journal covering the restricted area of mycological and lichenological taxonomy and nomenclature may not be self-evident in an era when proliferation of biological journals is an often unwelcome fact. We have conceived this journal to meet specific requirements that other journals have failed to serve.

To expedite publication was our first concern, for with the great majority of journals now printing the kind of articles acceptable to MYCOTAXON, a wait for publication after submission of a manuscript is frequently a year, often longer. MYCOTAXON aims to publish all manuscripts within four months of submission, often much more rapidly. To do this, the journal will appear quarterly, but the individual numbers will vary greatly in size, depending upon the amount of acceptable copy received.

To avoid assessment of page charges to authors or their institutions was our second concern. Many journals, faced with rising costs of publication, have resorted to charging authors for each page printed; in most cases, authors who plead financial hardship can still publish in such journals without paying the assessment. We feel that to place an author in the position of having to request financial relief is demeaning. Subscription prices must bear the burden of production costs for MYCOTAXON. We reject the concept of financing publication through page charges.

Still another problem arises with many conventional journals, in that they either strictly limit the length of articles they will accept (often only 8 or 10 pages), or will assess *excess* page charges for longer articles. If not impossible, it is often prohibitively expensive to publish a long monograph in such journals. MYCOTAXON is designed to accept articles of any length, from a one-page note to a book-length monograph. There are no charges for excess pagination.

Individual mycologists (as opposed to universities, libraries, and commercial concerns) who purchase journals for their own use should — we felt — be able to buy a subscription at or even below the actual cost of production. With this in mind we offer MYCOTAXON to *individuals* at a substantially reduced subscription fee compared with the regular subscription rate. In order to qualify for such a reduced fee, the individual subscriber agrees that the issues are for his personal use, and will be kept as part of his personal library (that is, *not* given or sold to an institutional or commercial library) for at least three years following the publication of an issue.

Since taxonomy and nomenclature transcend national and linguistic borders, we were also concerned with producing an international journal, open for publication to all mycologists and lichenologists. Manuscript is acceptable in either French or English; summaries, however, may be in any language.

Since final, camera-ready copy is provided by the authors, *no proofs* are needed and none are provided, effecting a great saving in time.

By using the process of photo-offset lithography, we believe that MYCOTAXON can and does meet the rigorous requirements we have set. Publication in the new journal asks *more*, perhaps *much more*, of an author than does publication in a conventional, type-set journal. By following the detailed instructions to authors which we provide, any author should be able to prepare suitable camera-ready manuscript with the assistance of a capable typist.

MYCOTAXON

Vol. I, No. 1, pp. 3-12 July-September 1974

INSTRUCTIONS TO AUTHORS FOR PREPARING CAMERA-READY MANUSCRIPTS FOR MYCOTAXON

RICHARD P. KORF

Plant Pathology Herbarium, Cornell University, Ithaca, NY 14850, U.S.A.

There are *six steps* which you should follow when you have completed your research if you wish to publish in MYCOTAXON. We urge you to read and re-read these instructions until you understand them fully.

Authors writing for MYCOTAXON are given complete freedom in certain matters. We feel that most often an author knows best how to present his material, and we do not wish to impose any of the usual editorial strictures on authors. Internal consistency within each article is far more important than consistency among different articles appearing in the journal. We do *require* that the manuscript be typed at a special size, single-spaced, and with a certain arrangement in the typing of the title, author's name, and author's address (see below, Step 4, §1, 4, 6). Otherwise we have only certain *recommendations*, as follows:

Title. A title should be as brief as is consistent with conveying enough information to someone reading the table of contents that he will be able to judge accurately the scope and content of the paper. Avoid the use of abbreviations in titles, and avoid any author citations in titles.

References. You may cite references however you wish, by author/date, by number, or by footnote. Journal names may be spelled out in full or abbreviated, but be consistent. We recommend that you use one of the conventional systems; that provided in *B—P—H* (*Botanico-Periodico-Huntianum*, published by Hunt Botanical Library, Pittsburgh, Pa.) is particularly good, as is that of the *World List of Scientific Periodicals* (published by Butterworth & Co., London).

Scientific names. Only the names of genera and infrageneric taxa (including the names of species and infraspecific epithets) should be *italicized;* other scientific names should be in Roman typeface. On typewriters in which italic type is not available, such names may be underlined instead. Do not use underlining for any other purpose.

Latin diagnoses. We request that you have your Latin diagnoses checked by a competent botanical Latin scholar.

Code of Nomenclature. Authors are urged to conform to the provisions of the International Code of Botanical Nomenclature.

Summaries. Short papers, 4 or fewer pages in length, probably do not require a summary. For longer papers, a summary is useful, and recommended. We suggest that it be placed first, before the text. The summary may be in the language of the original article, or in another or additional languages. We will accept up to three such summaries, *e.g.,* an article in English with English, Russian and Czech summaries would be wholly appropriate.

STEP 1. DETERMINE WHETHER YOUR WORK IS SUITABLE FOR MYCOTAXON

MYCOTAXON is specifically restricted to papers on the taxonomy and nomenclature of fungi and lichens. We intend this broadly, to include not only monographic work or proposals dealing with specific nomenclatural problems: we will also accept papers devoted to floristics, reviews of taxonomic groups or of taxonomic criteria, nomenclatural and taxonomic argumentation and polemics, proceedings of symposia on taxonomic or nomenclatural matters, subject, title or taxon indices of taxonomists' writings, etc. Papers that deal with ecology, cytology, physiology, pathology, ultrastructure, etc., unless their primary focus is taxonomic, should be submitted to some other journal.

When authors are in doubt as to the suitability of their paper for MYCOTAXON, they are urged to send a draft copy of their manuscript to the appropriate Editor for a decision as to whether the content would be acceptable for the journal.

STEP 2. PREPARE A DRAFT MANUSCRIPT AND OBTAIN PRE-SUBMISSION REVIEW

No articles will be accepted for publication in MYCOTAXON that have not been given critical review by a specialist in some institution other than that of the author(s). Unlike other journals, where the editors send a manuscript to reviewers *after* it has been submitted, MYCOTAXON insists that the author must himself first submit a completed draft (*not* camera-ready copy) of his manuscript, including copies of the plates, for *critical* comment to at least one scientist capable of judging the quality and presentation of the research results. This must be done *before* the author has his final manuscript typed for submission to MYCOTAXON. For papers 20 or more pages in length, *two* such pre-submission reviews are required. Usually an author knows best who is the most competent in his field to do such critical reviews. In those cases where an author is not certain whom to approach, he may send a draft copy of his manuscript (or a detailed abstract) to the appropriate Editor of MYCOTAXON, who will then suggest several possible reviewers. The comments of such reviewers should be carefully considered and the manuscript then altered to reflect these criticisms when they are judged to be constructive. Authors must submit the names and addresses of the outside reviewers to the Editors at the time the final manuscript is submitted, with the understanding that the Editors may contact such reviewers if they have questions concerning the content of the paper. At the close of each volume, the names of those who have provided pre-submission reviews of articles in MYCOTAXON will be acknowledged.

STEP 3. PLAN YOUR PLATES OF LINE DRAWINGS OR PHOTOGRAPHS FOR THE CAMERA-READY COPY

Photographs reproduce excellently with modern photo-offset lithography, and the method used is the production of a *halftone screen* by the printer. Gradations from white through grey to black are broken up into a series of dots of various sizes, just as is done with halftone plates printed by conventional letterpress methods. The same process is necessary for toned ink-wash or pencil drawings. The screen used in MYCOTAXON is a 150-line screen, which will reproduce excellent detail (but perhaps not the extremely fine detail needed to please workers publishing transmission electron micrographs, where a finer screen and glossy paper is needed).

Because halftone screens are an added expense, authors are allowed one halftone plate (up to page size) for each ten pages of manuscript, or fraction thereof. (An 11-page article thus qualifies for two halftone plates.) Authors who wish to publish papers with halftones in excess of this allowance should be prepared to pay for the extra cost of these (at 1974 prices, approximately $5.00 for each such halftone screen). There are no extra costs for line drawings, so these may be used in any quantity. MYCOTAXON has no provisions for publishing colored plates; preparation of these is so time-consuming and expensive that we cannot consider accepting such plates for publication.

The contrast among photographs grouped to make up one plate should not be too great. Plates should be planned to utilize the maximum page width whenever possible. Individual photographs making up a plate should be trimmed *squarely* on a good paper cutter so that the edges of adjacent photographs fit together neatly without any spaces between photographs. Commercially available press-on line stripping can be applied between the photographs, if desired. Immense care is essential, and the individual photographs should be mounted and grouped together on stiff paperboard, either with rubber cement or with photographic mounting tissue. Of course you should always use *glossy* prints for your plates.

Line drawings should always be made with black India ink. Individual line drawings can be cut out and assembled on a white background to make an attractive plate by gluing them to firm paperboard. The edges of these cut-outs will not reproduce if carefully glued, and need not be cut squarely. Plates of line drawings should also be planned to utilize full page width when possible. Do *not* mix photographs and line drawings in the same plate!

A WORD OF WARNING ON AMOUNT OF REDUCTION

Authors are cautioned against reducing their plates too much. Photographs reduced to less than 2/3 of their original size often suffer in reproduction. Line drawings should only very rarely be reduced to less than 1/2 of their original size. Leaving enough space *between* lines and dots used for shading is often more important than the width of the line or the diameter of the dot when line drawings are excessively reduced. Note also that lines which are too fine sometimes disappear entirely in reduction.

DETERMINING THE SIZE OF YOUR PLATE

Whether a plate is composed of photographs or of line drawings, an author will wish to determine the dimensions of the figures as they will be finally printed, to determine printed magnifications. If a figure does not occupy a full page, he will also want to determine the amount of space to leave blank on his final, camera-ready manuscript. The text of your article must be typed, according to whether you are using a Pica ("12 point") or an Elite ("10 point") typeface on your typewriter, on a specified size area (as indicated under Step 4, §1), i.e., 20 × 12.5 cm for Elite and 24 × 15 cm for Pica. In both cases there is some reduction between the size as submitted and the size when reproduced. The actual space that can be occupied by typed material or by a plate is, in the final printed version, a rectangle 17.6 × 11 cm (FIG. 1). There are five general options open to you which are outlined below.

(1) USING THE SAME REDUCTION AS THE TYPED TEXT

Surely the *easiest* plan for you and your typist is to allow your plate to receive the same reduction as your text. This means you would plan your plate to be 12.5 cm wide if your text is in Elite size, and any height not to exceed 20 cm; or, using a Pica typewriter, you would plan your plate 15 cm wide, and any height not exceeding 24 cm. In both cases the final width of the plate as printed will be 11 cm. You can, if you prefer, even insert your line drawings in their exact position in the manuscript when using this plan of reduction; do not do this with photographic plates, however, but instead leave the exact amount of blank space necessary in your typed copy. Submit your photographic plate, mounted on stiff paperboard, separately, since the printer must make a halftone screen from your photographic material before it can be reproduced.

(2) USING NO REDUCTION

If you desire to reproduce your figures at the exact size they are drawn or photographed, you should plan your plate to be 11 cm wide and not exceeding 17.6 cm in height.

(3) OTHER REDUCTION POSSIBILITIES

The relationship of final printed area, the area occupied by a figure on Elite or Pica manuscript paper, and any original figure size can be determined by consulting FIG. 1. The mathematics involved in computing final magnifications is relatively simple.

(4) ILLUSTRATIONS LESS THAN FULL PAGE IN WIDTH

While we do not recommend using less than full page width for illustrations, exceptions do exist where a small figure does not lend itself to the general rule. Any figure can be computed for reduction and fitted to the MYCOTAXON manuscript page by using the examples above and by consulting FIG. 1.

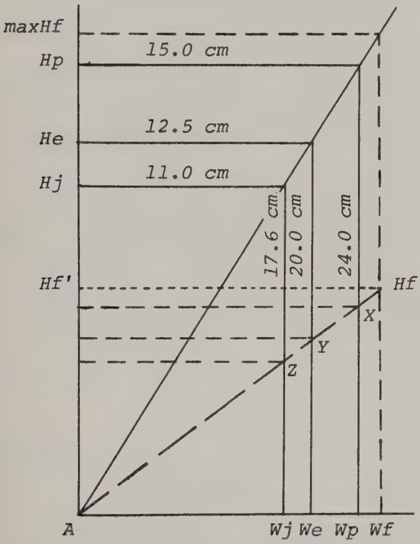

FIG. 1. *THE DIAGONAL METHOD OF PLATE PREPARATION.* Solid rectangles are established dimensions of *copy areas* for MYCOTAXON. A-Wj = *journal width* of printed copy = 11 cm. A-Hj = *journal height* of printed copy = 17.6 cm. A-We = permitted *Elite-typing width* = 12.5 cm. A-He = permitted *Elite-typing height* = 20 cm. A-Wp = permitted *Pica-typing width* = 15 cm. A-Hp = permitted *Pica-typing height* = 24 cm. A-Wf = actual *figure width*. A-maxHf = *maximum permitted height of a figure* A-Wf wide = 1.6 × A-Wf. A-Hf' = Wf-Hf = observed *height of figure* A-Wf wide. Wp-X = derived (measurable) *height* to be kept blank on a *Pica-typed manuscript* to allow insertion by the printer of figure A-Wf-Hf-Hf'. We-Y = derived (measurable) *height* to be kept blank on an *Elite-typed manuscript* for the same purpose. Wj-Z = *printed height* of such a figure.

(5) FIGURES SET LENGTHWISE ON THE PAGE

Occasionally a figure does not lend itself to a printed width of 11 cm, whereas it would adapt to being printed lengthwise on the page, where 17.6 cm is available for the width. There is no objection to this; one merely rotates the rectangles in FIG. 1 90° to the right. The legend is then typed the full length of the rectangle, rather than the width, if there is room for the legend on the same page.

LETTERING AND NUMBERING YOUR PLATES

This process can be done with India ink, whether on line drawings or photographs. Avoid hand-lettering, which almost always looks crude. We recommend the use of either a good lettering device or the use of press-on or of transfer letters now available from many commercial concerns in a wide variety of typefaces and sizes. These should be in black, or for use on dark portions of photographs, in white. A special sheet of transfer letters and symbols of particular convenience for biologists is called BIOPLATE. This contains a large proportion of the most commonly used letters and numbers for plates (in several sizes), various symbols useful in making graphs and maps, arrows, and even Greek letters that are seldom seen on normal transfer sheets. They are manufactured for us by a leading American firm, Prestype, Inc. They are available through the Managing Editor (see the back cover of the most recent issue of MYCOTAXON for the current prices).

ASSISTING YOUR TYPIST

After you have prepared your plates, it will be necessary for your typist to know exactly how much space to leave for insertion of the figure in the typed manuscript. One easy help is to construct a colored paper rectangle the correct size for the Elite or Pica manuscript paper by using the diagonal method of FIG. 1. If there is more than one figure, be sure to number each colored rectangle with the figure numbers to avoid any questions. Note that often the colored rectangle will be *larger* than your figure (*e.g.*, if you do not reduce at all, or only slightly), or it may be *smaller* (when your figure is to be reduced more than the Elite or Pica text reduction).

STEP 4. TYPING THE CAMERA-READY FINAL COPY

Your typist is the key to how attractive your manuscript will be. See that your typist has a copy of these instructions at hand, and that he or she knows exactly what is required. All typing must be done with a *carbon ribbon* to ensure good photographic reproduction with photo-offset lithography. The use of a fabric ribbon results in such poor reproduction that an Editor will be forced to reject manuscript so prepared. Best results are obtained with an electric typewriter. Hand-operated machines may be used if the typist has an even typing touch.

§1. *All* manuscript submitted to MYCOTAXON must be prepared so that the typed area is *wholly* within a rectangle, the dimensions of which are determined by the size of the typeface of the typewriter. The very great majority of typewriters are either Pica size (12 points, in printers' terminology), or the smaller Elite size (10 points). If the body of your paper is to be typed on a Pica-size machine, the rectangle within which all lettering must be kept is 24 × 15 cm. If it is an Elite-size typewriter, the rectangle is 20 × 12.5 cm. There should be *no exceptions*, and manuscripts that do not conform to this rule will be rejected. A very few typewriters have a typeface larger tha 12 points; for these, use the Pica-size rectangle. Do not use a typewriter with a typeface smaller than Elite size (10 points). As a convenience to prospective authors, we have prepared *special manuscript paper* with the rectangles ruled in light blue ink (which will not photograph). These may be obtained from the Managing Editor in packages of 50 sheets at our cost (consult the back cover of the most recent issue of MYCOTAXON for the current price.) While this manuscript paper is not necessary, it will be a great convenience to your typist; or you can rule your own rectangle on typing paper, using a *very light blue pencil* only. For many Pica typewriters the rectangle will accommodate a line 58 to 60 characters wide, and a page will be approximately 57 single-spaced lines in height. For many Elite typewriters the smaller rectangle will also accommodate a line 58 to 60 characters wide, but the page may be only about 48 single-spaced lines high (because most Elite typewriters use the same 12 point line spacing as do Pica typewriters).

§2. *Clean* the typing faces of your typewriter thoroughly before beginning to type. A dirty typeface yields poor results, and exactly what you type will be reproduced.

§3. *Don't erase* when preparing final copy, since erasures often show when the copy is photographed. Also do not strike over a letter a second time, since this results in a blacker than usual letter which clearly shows up in the printed copy. It is best to paint over any errors with typewriter correction fluid, and then retype the word or line a second time. Or, retype the word or line on a separate piece of paper, cut this out and glue it carefully onto the manuscript, using rubber cement, to cover the incorrectly typed word(s).

§4. All articles in MYCOTAXON will be provided by the Managing Editor with a journal identification at the head of the first page, like the one on this article (page 3). It is imperative that the typist leave sufficient blank space at the top of the title-page rectangle for this purpose. For Pica typewriting, leave 2.4 cm blank; for Elite typing, leave 2 cm blank. (The manuscript paper we have prepared and mentioned above [§1] has title guide marks.) The typist should center the title the appropriate distance down the title page of the manuscript, all in CAPITAL letters. Use no underlining in the title. Leave the next two lines blank. The name(s) of the author(s) must be centered, in CAPITAL letters, on the next line, followed by one blank line. Then the author's address should appear, either in upper and lower case *Italics* (as was done with this article), or in upper and lower case Roman letters. Two more blank lines should be used before beginning the summary or other text matter. An abstract or summary placed ahead of the text may be typed narrower that the main text if desired (see also §8, below).

§5. The first page (title page) of all articles (except those only one page in length) will always be an odd-numbered, *right-hand page*. Keep this in mind when planning the insertion of illustrations, particularly when the illustration is so large that its legend must appear on the facing page. An illustration appearing on manuscript page 9 requires its legend either on the same page or on manuscript page 8, its *facing page,* not on manuscript page 10 (which will always print on the back of manuscript page 9).

§6. The body of the text must be typed single-spaced. It is permissable, and preferable, to use 1½ or 2 spaces between paragraphs to help set them off.

§7. In the upper portion of each sheet of your manuscript place the name of the author and the manuscript page number. Keep this as far away from the text as possible. The *final* page numbers for the journal will be inserted by the Managing Editor above your typed rectangle. (If it is necessary for an author to refer in his text to another part of the same paper by the use of a page number, leave that page number out, and provide sufficient space so that the Managing Editor can insert the page reference [up to 3 numbers!] after he has assigned final page numbers. An obvious difficulty is that he may not be able to match exactly the same type style as you have used. You will also need to alert him at the time the manuscript is submitted, *e.g.,* "Page number must be inserted on MS pg. 10, line 14, referring back to MS pg. 6," so that he will be certain to insert the correct final page number at that point.)

§8. You are certainly not restricted to the use of one size of typeface in your article. Indeed, a larger typeface is most useful for the title, and for some headings. You can also space words for emphasis. Your decision on whether to use a Pica or an Elite rectangle size is based on which typewriter you use for the main text matter. An Elite typeface for the summary, Latin diagnoses, references cited, etc. is wholly appropriate in a Pica-typed manuscript.

§9. The great majority of typewriters have each letter of equal width, whereas in conventional typesetting the letter "i" for example is much narrower than the letter "M." There are a few typewriters that have *proportional spacing,* with letters of several widths, so that the final product looks much more like conventional printing that does the usual typewritten copy. The title of this article was typed on such a proportional spacing machine. Such machines produce more professional-looking copy, but are a luxury not available to many potential contributors.

§10. A very few typewriters allow you to type with different typefaces on the same machine. The most common of these, perhaps, is the IBM "Selectric" typewriter, in which the typing element is a removable ball that can be interchanged with others having a different type style or size of type. (IBM "Selectric" typefaces marked "10 pitch" are Pica size; those marked "12 pitch" are Elite size.) This article, with the exception of the title, is typed on such a machine.

§11. Most journals and books have not only their left, but also their right margins even, which is attained by the use of variable spacing between words. With proportional spacing typewriters it is feasible to produce such copy, technically termed "with a justified right margin," if one is a skilled typist. The copy is typed once, and then proportional spacing is added between words in a second, final typing. Somewhat similar results can even be obtained on a conventional spacing typewriter. If you will examine the legend to FIG. 1, on page 7, you will note that it is justified. Some spaces between words are single spaces, others 1½ spaces, still others 2 spaces, etc. We do *not* recommend that you ask your typist to produce justified copy with an ordinary typewriter, since this is a very time-consuming task and scarcely merits the work involved. Authors who have access to type composing machines that produce right-justified copy are of course free to submit their manuscripts in that form.

§12. The typist should consult the author concerning the position on the page to be occupied by any illustration and its legend. Careful placement of the figures will result in an attractive paper. When many figures occur, consider also the placment of figures on the facing page, and how their position will balance with the figures on the page with which you are now working. While figures are normally inserted on the same page or that next following their first mention in the text, aesthetics may dictate otherwise.

§13. Since footnotes appear at the bottom of pages, and legends either at the bottom of the figure or on the facing page, the typist will need to type out the full footnote or legend ahead of time in order to allow sufficient space in the text for these to appear where they belong.

§14. If an author discovers that he simply cannot obtain the services of a typist capable of producing good, camera-ready copy, the Managing Editor is willing to find a professional typist who can type the manuscript under his supervision, if the author is prepared to pay for such services. Preparation of plates, however, *must* be done by the author. Those wishing to proceed in this manner should send a draft of their paper to the Managing Editor, who will obtain an estimate of the costs for professional typing. Such preparation may delay publication of the article to the following issue.

STEP 5. ABOUT REPRINTS OF YOUR ARTICLE

Most authors want to order reprints of their articles. For papers in MYCOTAXON it will be possible for authors to obtain reprints very rapidly. As soon as an issue of MYCOTAXON has been printed, the Managing Editor will mail the original photo-offset negatives to the senior or only author. The author can take these to his nearest printing shop that does photo-offset work and they can reproduce his paper directly from these negatives. (They can also copy directly from the printed journal, but at times a slight loss in quality of reproduction occurs with that method.) Since some authors will wish to provide a cover for their reprints, a special title sheet designed for their particular paper will also be sent along with the original negatives.

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THE GENUS MASSOSPORA, ENTOMOPATHOGENIC FOR CICADAS, PART I, TAXONOMY OF THE GENUS[1,2]

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SUMMARY

Major collections of cicadas in the western hemisphere were searched for specimens infected with *Massospora*. This effort resulted in the discovery of eight new species herein described as: *M. dorisiana; M. ocypetes; M. tettigates; M. carineta; M. diminuta; M. platypedia; M. diceroprocta;* and *M. fidicina*. The clearer understanding of the genus *Massospora* gained through this study has permitted an emendation of the generic description. The new name *Entomophthora porteri* is proposed for *M. tipulae* since it properly belongs in the genus *Entomophthora* and retention of the specific epithet would create a homonym.

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[1] Insect Pathology Research Institute, Sault Ste. Marie Ontario Contribution No. 277.

[2] This paper is based in part on a thesis submitted in partial fulfillment of the requirements for the degree of Doctor of Philosophy, Cornell University, Ithaca, New York. Supported in part by an NIH Pre-Doctoral Fellowship.

INTRODUCTION

Following the discovery of the fungus *Massospora levispora* Soper (1963) in populations of the northern cicada *Okanagana rimosa* (Say), investigations were initiated to determine the nature of *Massospora* pathogens. This study was developed along three lines of research. First, a search of numerous cicada collections at various museums was made in an attempt to locate *Massospora* infected individuals. This search was intensified in 1967 when a collecting trip to the Caribbean, Central, and South America was undertaken. These efforts proved very successful and a number of new *Massospora* species were discovered. This has allowed for a more complete understanding of the taxonomy of this group. Concurrent with this effort, the second line of research involved a detailed study of the biology of *O. rimosa* and its pathogen, *M. levispora.* This was supplemented by studies of *Massospora cicadina* Peck on the 13 and 17-year cicadas, *Magicicada* spp. Field trips were made to Illinois and Iowa to observe the 13 and 17-year cicada emergence in 1963 and Ohio to observe 17-year cicada emergences during 1965 and 1968. The third area of research was an epizootiological investigation of *M. levispora* in an isolated population of *O. rimosa.* Data for this portion of the investigation were collected during emergence of large numbers in 1967 and 1969. The results of these investigations are to be presented in three papers: (1) Taxonomy of the genus; (2) Biology of *Okanagana rimosa* and its pathogen, *Massospora levispora*; and (3) Epizootiology of *Massospora levispora* in an isolated population of *Okanagana rimosa*.

The genus *Massospora* was established by Peck (1879) with the description of *M. cicadina.* He placed this genus in the Coniomycetes near the genus *Protomyces.* Forbes (1888) and Thaxter (1888) concluded independently that *Massospora* belonged to the Entomophthoraceae. This was confirmed by the detailed observations of Speare (1921) and Goldstein (1929). *Massospora cicadina* was found to be a pathogen of adult 17-year cicadas, *Magicicada septendecim* (L.). Subsequently, it has been found to attack all species of *Magicicada* in the eastern and midwestern United States (Soper, 1963). Two other *Massospora* species have been observed attacking cicadas.

Ciferri *et al.* (1957) described *M. spinosa* Ciferri, Machado and Vital from adult cicadas of *Quesada gigas* (Olivier) from northeastern Brazil. Soper (1963) described *Massospora levispora* Soper from adult cicadas of the species *Okanagana rimosa* (Say) from northern Ontario. Other fungal species attributed to *Massospora* have since been relegated to different entomogenous genera. *Massospora cleoni* Wize, and *Massospora richteri* Bresadola and Startz were transferred to *Entomophthora* by Bubak (1903, 1906, 1916). Recently MacLeod and Müller-Kögler (1970) transferred *Massospora tipulae* Porter to the genus *Entomophthora*. *Massospora staritzii* Bresadola has been placed in the genus *Sorosporella* by Speare (1920) and recently MacLeod and Müller-Kögler (1970) expressed the opinion that Bubak (1916) has correctly transferred this species to the genus *Entomophthora*.

It is now evident that the three valid species, *M. cicadina*, *M. spinosa*, and *M. levispora*, together with eight new species described in this paper, constitute a small unique group of entomogenous fungi. The genus *Massospora* is confined to the terminal portion of the abdomen attacking primarily the genitalia of adult cicadas. They have been collected in North America from northern Ontario, Canada south to the Florida Keys and west to Nevada; in the Caribbean from Cuba; in Central America from Mexico and Honduras; in South America from Argentina, Brazil, Chili, Venezuela; and from southeast Asia in Japan. *Massospora* species have been found to attack only cicadas that are gregarious and occur in large numbers. Most of the major cicada collections in the United States and South America have been searched for fungus infected specimens and no solitary cicadas have been found infected even though eight new *Massospora* species were discovered. The information gained during this study now allows for a more detailed description of the genus.

Massospora Peck emend. Soper

31st Rept. N. Y. State Museum Nat. Hist. p. 44. 1879. Pathogenic to adult cicadas, fungus growth confined to abdomen of host; spores of two types generally do not occur simultaneously or consecutively within the same insect; conidia usually binucleate, sometimes uninucleate or multinucleate, arising within irregular cavities formed within the host abdomen, exposed by the sloughing off of the abdominal segments, cavity wall rupture and release of conidia at maturity, not forcibly ejected from conidiophores; resting spores globose, epispore reticulated, arising from hyphal bodies within the host's abdomen but not in chambers. (Fig. 1 and 2).

Type species: *Massospora cicadina* Peck.

This genus can be easily separated from the other entomogenous genera of the Entomophthoraceae in several respects. The conidia of *Massospora* are produced in chambers within a mycelial mass whereas in other genera they are forcibly ejected from conidiophores. All *Massospora* species produce reticulated resting spores whereas most Entomophthoraceae produce smooth walled resting spores or if ornamented, then not reticulated. Also, so far as known, *Massospora* species grow only in the abdomen of cicadas.

The herbaria referred to in this paper have been abbreviated as follows: BPI - National Fungus Collection, Beltsville, Maryland; CUP - Cornell University, Ithaca, New York; DAOM - Canada Department of Agriculture, Ottawa, Ontario, Canada; FH - Farlow Herbarium, Harvard University, Cambridge, Mass.; URM - Institute of Mycology, Federal University, Recife, Brazil; MICH - University of Michigan, Ann Arbor; and NYS - New York State Museum, Albany, New York.

PREVIOUSLY KNOWN SPECIES

1. *Massospora cicadina* Peck, 31st Rept. N. Y. State Museum Nat. Hist. p. 44. 1879.

Conidia verrucose, ovoid, papilla noticeable but not prominent, 10 - 17μ x 14 - 20μ (av. 15.5μ x 18.5μ), binucleate, creamy white in mass; resting spore reticulation forming relatively uniform chambers, ridges of reticulation with small rounded projections, width and height of projections about equal, 33.5μ x 47.5μ (av. 40.5μ), tetranucleate, brown in mass. (Fig. 3a,b).

Holotype: UNITED STATES: New York: Livingston, Columbia Co., and Albany: In the abdomen of an adult 17-year cicada, *M. septendecim*. Conidial stage. June 1877, *Coll. Peck*. NYS.

Hosts: HOMOPTERA: *Magicicada septendecim*, *Magicicada cassini* (Fisher), *Magicicada septendecula* Alexander and Moore, *Magicicada tredecim* (Walsh and Riley), *Magicicada tredecassini* Alexander and Moore, and *Magicicada tredecula* Alexander and Moore (Cicadidae), (Soper, 1963).

This species has been reported from the cicada *Platypleura kaempferi* F. in Japan (Kobayasi, 1951) and from the cicada *Diceroprocta biconica* Walker in Cuba (Weiser and Stary, 1967). These observations were made of cicadas infected with reticulated resting spores. Undoubtedly they were species of *Massospora* but their identification as *M. cicadina* is questionable.

2. *Massospora spinosa* Ciferri, Machado, and Vital, Ist. Bot. Reale Univ. Reale Lab. Crittog. Pavia Atti, Ser. 5, 14: 17. 1957.

Conidia, verruculose, ovoid to ellipsoidal, slightly crenate in cross section, papilla indistinct, 6.4 - 9.6μ x 9.6 - 22.5μ (av. 8.3μ x 15.2μ), binucleate with nuclei bipolar, brown in mass; resting spore reticulation forming relatively uniform chambers, ridges of reticulation with small projections usually bluntly pointed to truncate, 35-45μ (av. 38.5μ), brown in mass. (Fig. 4).

Holotype: BRAZIL: Paraiba: Areia: Campus of Escola de Agronomia do Nordeste: Growing in the abdomen of an adult cicada, *Q. gigas*, Det. T. E. Moore. Resting spore stage. *Coll. Machado 5343*. URM.

Other specimens examined: Same data as holotype *Coll. Machado 3574, 3575, 3576* and *5345*. URM. MEXICO: Apodaca NL: Growing in the abdomen of an adult cicada, *Q. gigas* Det. T. E. Moore. Conidial stage. 10 Oct. year unknown. *Coll. A. Rumay Jr*. CUP. VENEZUELA: Caracas: Campus of Instituto de Zoologica Tropical, Universidad Central de Venezuela: Growing in the abdomens of adult cicadas, *Q. gigas*, Det. T. E. Moore. Resting spore and conidial stages. 14 April 1967, *Coll. Soper*. CUP, BPI, FH.

Collection *Machado 5345* was labeled *Allomyces* sp. This is apparently the *Allomyces* reported by Ciferri et al. (1957) on cicadas. It is, in fact, the conidial stage of *M. spinosa*.

Hosts: HOMOPTERA: *Quesada gigas* (Cicadidae).

The resting spores of this species are similar to *M. cicadina* but the sculpturing on the ridges of the reticulations is different. The small papillae in *M. spinosa* are shorter and less rounded. The spores are also slightly smaller averaging 38.5µ vs. 40.5µ. The conidia are very dissimilar being ovoid to ellipsoidal with nuclei located at the ends of the spore in *M. spinosa* whereas they are ovoid with random placement of nuclei in *M. cicadina*. The conidia in *M. spinosa* are smaller averaging 8.3µ x 15.2µ vs. 15.5µ x 18.5µ in *M. cicadina*.

3. *Massospora levispora* Soper, Can. J. Bot. 41: 875. 1963.

Conidia smooth walled, ellipsoidal to ovoid, papilla prominent, 6.0 - 11.0µ x 9.5 - 23.0µ (av. 8.0µ x 15.0µ), binucleate, occasionally trinucleate or uninucleate, located at random within the spore, creamy white in mass; resting spore reticulation broad irregular bearing many small rounded papillae, 27.5 - 40.5µ (av. 34.0µ) yellowish brown in mass. (Fig. 3c, d).

Holotype: CANADA: Ontario: Algoma District: 4 miles east of Searchmont near Whitman Dam: Growing in abdomen of adult female cicada, *Okanagana rimosa*. Conidial stage. 28 June 1962, *Coll. Soper*. DAOM 90058.

Paratype: Same locality data as holotype. Growing in abdomen of male cicada, *O. rimosa*. Resting spore stage. 5 July 1962, *Coll. Soper*. DAOM 90059. Both spore stages deposited, BPI 71717 and 71718, FH, MICH, and CUP. UNITED STATES: California: Mono County: East shore Black Lake: Growing in abdomen of male cicada, *Okanagana sperata* Van Duzee, Det. T. E. Moore. Conidial stage. 6 July 1961, *Coll. A. Beck*. CUP.

Hosts: HOMOPTERA: *Okanagana rimosa* and *Okanagana sperata* (Cicadidae).

The resting spores of *M. levispora* can be easily distinguished from those of other *Massospora* species. The irregular reticulated epispore bearing many small papillae is unique. The conidia can be separated from other species on the basis of the smooth walls, distinct papilla and random location of the two to three nuclei. (cf. Soper, 1963 Fig. 4).

NEWLY DESCRIBED SPECIES

4. *Massospora dorisiana* Soper, sp. nov.

Conidia verruculosa, apparenter transectione crenata, obovata aut ellipsoidea ad navicularia, late acuta apice, base paulum truncata 9.6 - 12.8μ x 16.1 - 28.9μ (med. 10.8μ x 21.8μ) binucleata bipolaribus nucleis, in cumulo cremeoalba; dorminentes sporae ignotae.

Conidia verruculose appearing crenate in cross section, obovate or ellipsoidal to navicular, broadly acute at the tip, slightly truncate at base, 9.6 - 12.8μ x 16.1 - 28.9μ (av. 10.8μ x 21.8μ), binucleate with bipolar nuclei, creamy in mass; resting spores unknown. (Fig. 5a).

Holotype: BRAZIL: Paraiba: Areia: Campus of Escola de Agronomia do Nordeste: Growing in the abdomen of an adult cicada, *Dorisiana semilata* (Walker), Det. T.E. Moore. Conidial stage. March 1955, *Coll. Machado 5346.* URM.

Name: This species is named for the genus of cicada which it attacks, *Dorisiana.*

Host: HOMOPTERA: *Dorisiana semilata* (Cicadidae).

The conidia are very dissimilar from other *Massospora* species. They are navicular with nuclei located at the ends of the spore and are quite large averaging 10.8μ x 21.8μ.

5. *Massospora ocypetes* Soper sp. nov.

Conidia verruculosa, ovoidea ad ellipsoidea, latis definitis papilla, 6.5 - 9.0μ x 9.0 - 19.4μ (med. 7.0μ x 12.0μ) nuclei indefiniti videntur ut massa brunnea; reticulatio dormientis sporae uniformiores loculas formans, in cristis nullae papillae, 28.9μ - 41.7μ (med. 34.3μ) videntur ut massa brunnea.

Conidia verruculose, ovoid to ellipsoidal, with broad distinct papilla, 6.5 - 9.0μ x 9.0 - 19.4μ (av. 7.0μ x 12.0μ) brown in mass, nuclei indistinct; resting spore reticulation forming relatively uniform chambers, lacking papillae on ridges, 28.9μ - 41.7μ (av. 34.3μ) brown in mass. (Fig. 6).

Holotype: ARGENTINA: Gualeguaychu: R. A. Entre Rios: Growing in the abdomen of an adult cicada, *Dorisiana bonaerensis* (Berg), Det. R. Froeschner. Fungus in resting spore stage. December-March, year unknown, *Coll. H. Rossi.* CUP.

Paratypes: Same collection data as holotype. Conidial and resting spore stages, CUP, BPI, and FH.

Name: This species is named for Ocypete, one of the Harpies who infected everything she touched.

Host: HOMOPTERA: *Dorisiana bonaerensis* (Cicadidae).

The resting spores of *M. ocypetes* can be distinguished from those previously described by the lack of distinct papillae on the reticulations. They are also smaller averaging 34.3μ vs. 38.0μ for *M. dorisiana*, 38.5μ for *M. spinosa* and 40.5μ for *M. cicadina*. The conidia are very similar to *M. levispora* but the reticulation on the resting spores leaves little doubt that they are different species.

Dr. A. Willink, Miguel Lillo Foundation, Tucuman, Argentina, has related a very interesting folk superstition concerning this species. The natives living in the Entre Rios area believe that cicadas have the power to heal themselves. When their abdomens fall off, the cicadas pack them with mud to prevent bleeding. These observations correspond, of course, to the maturation of the conidial stage of *M. ocypetes*.

6. *Massospora tettigates* Soper sp. nov.

Conidia parietibus laevibus, ovoidea, papilla indefinita, 6.4 - 8.3μ x 9.0 - 15.5μ (med. 8.3μ x 13.0μ), multinucleata, cum 2 ad 6 nucleis, videntur recentia sicut massa ochroleuca, nigrescentia aetate; dormiens spora latis reticulationibus, papillae minutae et idefinitae, 28.9 - 41.7μ (med. 36.3μ), videntur ut massa ochracea.

Conidia smooth walled, ovoid, papilla indistinct, 6.4 - 8.3µ x 9.0 - 15.5µ (av. 8.3µ x 13.0µ), multinucleate with 2 to 6 nuclei, creamy white in mass when fresh turning black with age; resting spore with broad reticulations, papillae minute and indistinct, 28.9 - 41.7µ (av. 36.3µ), light brown in mass. (Fig. 7).

Holotype: CHILI: Santiago: 1800-2000 m. Camino a Farellones: Growing in abdomen of adult cicada, *Tettigates* sp. Resting spore stage present. 21 December 1969, *Coll. L. E. Pena G.* CUP.

Paratypes: Same collection data as holotype. Resting spores and conidial stages present, CUP, FH and BPI.

Name: The species name is based on the genus of cicada which serves as its host, *Tettigates*.

Other specimens examined: CHILI: Aconcagua Province: Jahuel: Lat. 37° 50' South, long. 71° 44' East, near Mulcher on the Rio Bio. Growing in abdomen of cicada, *Tettigates* sp. Conidial stage. 23 December 1963, *Coll. Pino*. Penehue: 1381 m. In abdomen of adult *Tettigates* sp. (different than host of Holotype). Resting spore stage. 10 January 1946, *Coll. L. E. Pena G.* CUP.

Host: HOMOPTERA: *Tettigates* spp. (Cicadidae).

The resting spores of *M. tettigates* are easily recognized by their broad reticulations. No other species of *Massospora* even closely resembles *M. tettigates* in this respect. The smooth conidia of this species can be distinguished from *M. levispora* by the absence of a distinct papilla and multinucleate condition. The conidia of *M. tettigates* tend to be broadly ovoid as opposed to the ovoid to ellipsoidal conidia of *M. levispora*.

7. *Massospora carineta* Soper sp. nov.

Conidia verrucosa, globosa ad subglobosa, nulla papilla, 9.0 - 11.6µ (med. 10.0µ), binucleata, videntur ut massa brunnea; dormientes sporae ignotae.

Conidia verrucose, globose to subglobose, papilla absent, 9.0 - 11.6µ (av. 10.0µ), binucleate, brown in mass; resting spores unknown. (Fig. 5b).

Holotype: BRAZIL: Sao Paulo: Barueri: Engenho Tres Pedras: Growing in the abdomen of an adult cicada *Carineta* sp. Conidia present. 25 June 1950, *Coll. O. P. Keller.* CUP.

Paratypes: BRAZIL: Sao Paulo: Barueri: Growing in the abdomen of cicada, *Carineta* sp. Conidia present. 26 April 1956, BPI and FH. Osasco: Growing in the abdomen of a cicada, *Carineta* sp. Conidial stage present. 27 February 1951, *Coll. O. P. Keller.* CUP.

Other Specimens Examined: ARGENTINA: Misiones: Growing in the abdomen of *Carineta* sp. Conidia present. January 1956. CUP.

Name: The cicada genus *Carineta* was used as a basis for this specific name to indicate its host.

Host: HOMOPTERA: *Carineta* sp. (Cicadidae).

Only *M. carineta* is known to have globose conidia.

8. *Massospora diminuta* Soper sp. nov.

Conidia ignota; dormientis sporae reticulatio cum multis latis truncatis papillis, 22.5μ - 32.1μ (med. 27.0μ).

Conidia unknown: resting spore reticulation with many broad truncate papillae 22.5μ - 32.1μ (av. 27.0μ). (Fig. 8a, b).

Holotype: BRAZIL: Amapa: Rio Tracajatuba: Growing in abdomen of an adult, *Cicada* sp.? Resting spores present, December 1964. CUP.

Name: The species name is based on the Latin diminutivus (small) since this is both the smallest cicada known to be attacked by *Massospora* and the smallest *Massospora* resting spore described.

Host: HOMOPTERA: *Cicada* sp.?(Cicadidae).

The resting spore of *M. diminuta* can be distinguished from all other *Massospora* species by the small size, average 27.0μ.

9. *Massospora platypedia* Soper sp. nov.

Conidia laevia, late ellipsoidea, papilla lata et definita, 5.2 - 7.7μ x 6.5 - 12.9μ (med. 6.0μ x 9.9μ) binucleata nucleis bipolaribus, videntur ut massa cremeo-alba; dormientes sporae ignotae.

Conidia smooth, broadly ellipsoidal, papilla broad and distinct, 5.2 - 7.7μ x 6.5 - 12.9μ (av. 6.0μ x 9.9μ), binucleate with nuclei bipolar, creamy white in mass; resting spores unknown. (Fig. 5c).

Holotype: CALIFORNIA: Shasta Co.: Redding: Growing in the abdomen of an adult cicada, *Platypedia putnami* var. *keddiensis* Davis, Det. T. E. Moore. Conidial stage present. 15 June 1956. *Coll. W. Wiard.* CUP.

Paratype: Same data as holotype. Conidial stage present, BPI, CUP, and FH. Growing in abdomen of *P. putnami* var *putnami* (Uhler), Det. T. E. Moore. Conidial stage present. 9 June 1942, *Coll. J. L. S.* CUP. NEW MEXICO: Tajique: Growing in abdomen of *P. putnami* var. *lutea* Davis, Det. T. E. Moore. Conidial stage present. 25 June 1941, *Coll. E. L. Todd.* CUP. UTAH: Zion National Park: Growing in the abdomen of *P. putnami* var. *keddiensis* Davis, Det. T. E. Moore. Conidial stage present. 24 June 1949, *Coll. W. H. Lange.* CUP.

Name: The species name is based on the genus name of the host cicada *Platypedia*.

Host: HOMOPTERA: *Platypedia putnami* var. *putnami*, var. *keddiensis*, and var. *lutea*, (Cicadidae).

This species can be distinguished from *M. levispora* which also has smooth walled conidia by the bipolar placement of its two nuclei. The conidia of *M. platypedia* are of more uniform shape being broadly ellipsoidal. Although the papillae are distinct, they are not as prominent as in *M. levispora*.

10. *Massospora diceroprocta* Soper sp. nov.

Conidia verruculosa, anguste ellipsoidea aut fusiforma ad ellipsoidea aut obovata, papilla indefinita, 6.5 - 7.7μ x 11.6 - 20.6μ (med. 6.8μ x 17.1μ) marores sporae utroque fine accuminatae, binucleatae cum nucleis bipolaribus, videntur recentia ut massa violacea; dormientes sporae ignotae.

Conidia verruculose, narrowly ellipsoidal or fusiform to ellipsoidal or obovate, papilla indistinct, 6.5 - 7.7μ x 11.6 - 20.6μ (av. 6.8μ x 17.1μ), larger spores acuminate at both ends, binucleate with nuclei bipolar, violet in mass when fresh; resting spores unknown. (Fig. 5d).

Holotype: TEXAS: Laredo: Growing in the abdomen of an adult *Diceroprocta delicata* (Osborn), Det. R. Froeschner. Conidial stage present. 26 August 1971, *Coll. J. A. Palmer.* CUP.

Paratype: Same data as holotype. Conidial stage present. BPI. TEXAS: Hidalgo County: Alamo: Growing in abdomens of cicadas *D. delicata* and *D. cinetifera.* Det. R. Froeschner. Conidial stage present. 25 August 1970, *Coll. D. Dalager.* BPI. Mission: Growing in the abdomen of *Diceroprocta cinetifera* var. *viridicosta* Davis. Det. T. E. Moore. Conidial stage present. Date and Coll. unknown. CUP: Weslaco: Growing in the abdomen of *D. delicata.* Det. T. E. Moore. Conidial stage present. 21 July 1930, *Coll. S. W. Clark.* CUP.

Name: This species is named for the genus of cicada on which it is found, *Diceroprocta.*

Other specimens examined: Two specimens of *Diceroprocta* have been located which harbor resting spores of *Massospora* species. These resting spores are very similar to *M. cicadina.* They are on species of *Diceroprocta* other than those on which the type of *M. diceroprocta* is based. Also, they are from areas remote from its type locality which is the Rio Grand Valley, Texas. For these reasons, they have not been described as *M. diceroprocta.* The collection data on these specimens are as follows: LOUISIANA: Location unknown: Growing in abdomen of *Diceroprocta vitripennis* (Say). Det. T. E. Moore. Resting spores present, 31.0μ - 44.0μ (av. 40.2μ). July 1885. CUP. FLORIDA: Key Largo: Growing in abdomen of *D. biconica* (Walker). Det. T. E. Moore. Resting spores present, 32.3μ - 40.0μ (av. 35.5μ). 9 August 1930, *Coll. R. H. Beamer.* CUP. The resting spores from these two species are shown in Fig. 9. Although the ornamentation on the reticulations are similar, (Fig. 9b, d), the ridges themselves appear different. Those of the *D. vitripennis* specimen are broader than those from *D. biconica* (Fig. 9a, c). Also, the resting spores from *D. vitripennis* average larger, 40.2μ vs. 35.5μ which is similar to *M. cicadina*, i.e., 40.5μ.

Host: HOMOPTERA: *Diceroprocta cinetifera* var. *viridicosta* and *Diceroprocta delicata* (Cicadidae).

The conidia of *M. diceroprocta* are quite different from any other known *Massospora*. The ellipsoidal to fusiform shape separates them from all others. Only *M. dorisiana* has conidia close to this species but these are broader and much larger 10.8μ x 21.8μ vs. 6.8μ x 17.1μ.

11. *Massospora fidicina* Soper sp. nov.

Conidia verruculosa, ovoidea, aliquando subglobosa, papilla indefinita, 7.7 - 9.0μ x 9.0 - 14.2μ (med. 8.2μ x 11.1μ), uninucleata, videntur sicut massa cremeo-alba; dormiens spora tenuibus reticulationibus, margines cum multis truncatis papillis, papillae longitudine pares latitudini aut maiores 35.5μ - 41.3μ (med. 37.9μ) videntur sicut massa ochrea.

Conidia verruculose, ovoid, occasionally subglobose, papilla indistinct, 7.7 - 9.0μ x 9.0 - 14.2μ (av. 8.2μ x 11.1μ), uninucleate, creamy white in mass; resting spore with fine reticulations, ridges bearing many truncate papillae, papilla length equal to, or greater than, width, spores 35.5μ - 41.3μ (av. 37.9μ) light brown in mass. (Fig. 10).

Holotype: HONDURAS: Guaimas District: Tela: Growing in abdomen of an adult *Fidicina* sp. Resting spore stage present. 1 June 1923, *Coll. T. H. Hubbell.* CUP.

Paratype: Same data as holotype. Resting spores present, BPI. MEXICO: Chiapas: 11 mi. north of Arriaga: Growing in abdomen of *Fidicina* nr. *pronoe*. Det. T. E. Moore. Conidial stage present. 2 June 1941, *Coll. I. J. Cantrall.* CUP.

Name: The species name of this *Massospora* is based on the generic name of its host *Fidicina*.

Host: HOMOPTERA: *Fidicina* sp. (Cicadidae).

The conidia of this species are similar to *M. platypedia* in shape. They can be distinguished by being verruculose vs. smooth, uninucleate vs. binucleate, and slightly larger, 8.2µ x 11.1µ vs. 6.0µ x 9.9µ. The resting spores of *M. fidicina* are similar to those of *M. spinosa* both being approximately 38µ in diameter. The papillae on reticulations of *M. fidicina* are wide and truncate while those of *M. spinosa* are generally rounded, although occasionally truncate.

EXCLUDED SPECIES

Massospora tipulae is generally considered a species of *Entomophthora* (MacLeod and Müller-Kögler, 1970). The placement in this genus is correct, but since there exists the species *Entomophthora tipulae* Fresenius, 1856, MacLeod and Müller-Kögler have created a homonym. The holotype of *M. tipulae* was obtained from BPI and an emended description based on this material is provided below.

Entomophthora porteri nom. nov. (Basionym: *Massospora tipulae* Porter, J. Elisha Mitchell Sci. Soc. 58: 65. 1942, non *E. tipulae* Fres. 1856).

Conidial stage unknown; resting spores bearing many finger-like projections, globose to subglobose, 36.1µ - 45.2µ (av. 38.8µ), dark brown, black in mass, cup-like appendage at point of attachment; hyphal bodies colorless, various shapes, commonly elongate, 19.4 - 32.2µ x 90.3 - 116.1µ. (Fig. 8c, d).

Holotype: TENNESSEE: Knoxville: Cherokee Farm: Growing in body of adult cranefly, *Tipula triplex* var. *colei* Alexander. Resting spore stage. 21 April 1938, *Coll. A. C. Cole* and *C. Huffacker*. BPI as no. 4400 Flora of Tennessee.

Host: DIPTERA: *Tipula triplex* var. *colei* (Tipulidae).

Name: This species is named after Dr. J. P. Porter who originally recognized this fungus as new to science (Porter, 1942).

SYNOPTIC KEY TO SPECIES

The following synoptic key was devised to assist in the identification of cicadas infected with *Massospora*. The method used to employ this type of key was explained in detail by Korf (1972). Any of the listed characteristics may be used as a first possible entry into the key. This will usually lead to a choice among several species. Additional characters are then examined until a unique combination is found for one species. If the specimen to be keyed is in the resting spore state, then generally it will be necessary to utilize scanning electron microscopy to make a definative determination. The underlined numbers indicate species showing only one of the alternatives in any character grouping. For the purposes of this key, the undescribed species occurring in cicadas *Diceroprocta* spp. have been assigned numbers i.e., 13. *D. biconica* and 14. *D. vitripennis*.

CONIDIAL CHARACTERS

1-1. *Conidial shape*

a. ellipsoidal 2, 3, 4, 5, 9, 10
b. fusiform 10
c. globose 7
d. navicular 4
e. obovate 4, 10
f. ovoid 1, 2, 3, 5, 6, 11
g. subglobose 11, 7

1-2. *Conidial wall ornamentation*

a. absent 3, 6, 9
b. verrucose 1, 2, 7
c. verruculose 4, 5, 10, 11

1-3. *Number of nuclei*

a. one 3, 11
b. two 1, 2, 3, 4, 6, 7, 9, 10
c. three 3, 6
d. four or more 6

1-4. *Arrangement of nuclei*

a. bipolar 2, 4, 9, 10
b. random 1, 3, 6, 7

1-5. *Conidial length*

a. less than 8μ 9
b. 8 to 10μ 2, 3, 5, 6, 7, 9
c. 10 to 15μ 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11
d. 15 to 20μ 1, 2, 3, 4, 5, 6, 10
e. more than 20μ 2, 3, 4, 10

RESTING SPORE CHARACTERS

2-1. *Ornamentation of resting spore reticulum*

a. papillae absent 5
b. papillae minute 6
c. papillae rounded 1, 2, 3, 13, 14
d. papillae truncate 2, 8, 11, 13, 14

2-2. *Ridges of reticulum*

a. broad forming small chambers 6
b. irregular forming indistinct chambers 3
c. narrow forming distinct chambers 1, 2, 5, 8, 11, 13, 14

2-3. *Resting spore diameter*

a. less than 25μ 8
b. 25 to 30μ 3, 5, 6, 8
c. 30 to 45μ 1, 2, 3, 5, 6, 11, 13, 14
d. more than 45μ 1

HOST

3-1. *Genus of cicada attacked*

a. *Carineta* 7
b. *Cicada*? 8
c. *Diceroprocta* 11, 13, 14
d. *Dorisiana* 4, 5

e. *Fidicina* 11
f. *Okanagana* 3
g. *Platypedia* 9
h. *Quesada* 2
i. *Tettigates* 6

ACKNOWLEDGEMENTS

Drs. T. E. Moore, University of Michigan, and R. Froeschner, Smithsonian Institute, provided the identifications of the cicada species cited in this paper. Dr. D. Tatem, University of Maine, provided the Latin translations of the species descriptions. Their help is gratefully acknowledged.

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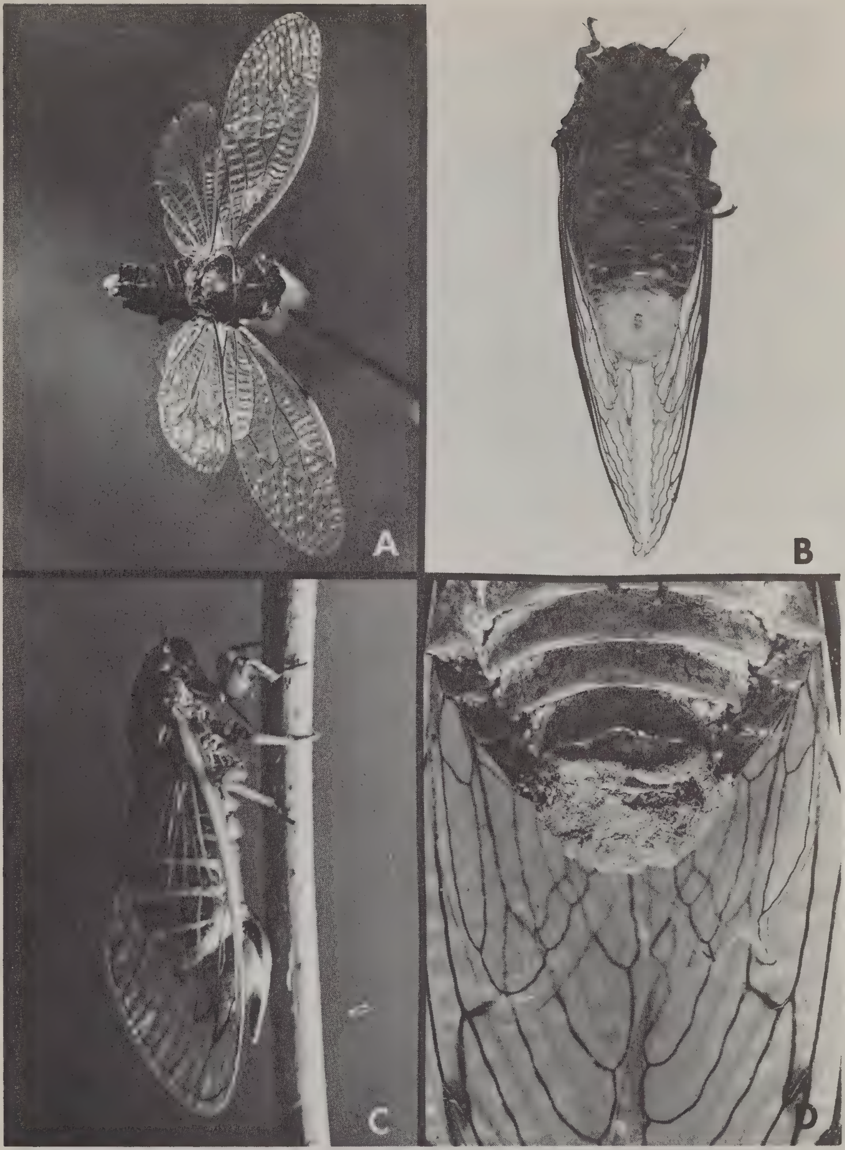

Figure 1. Cicadas infected with conidial stage of *Massospora*: (A) *Platypedia putnami* infected with *M. platypedia* 2.5 x; (B) *Okanagana rimosa* infected with *M. levispora* 2.5 x; (C) *Magicicada septendecim* early stage of *M. cicadina* 2 x; and *Quesada gigas* infected with *M. spinosa* 4 x.

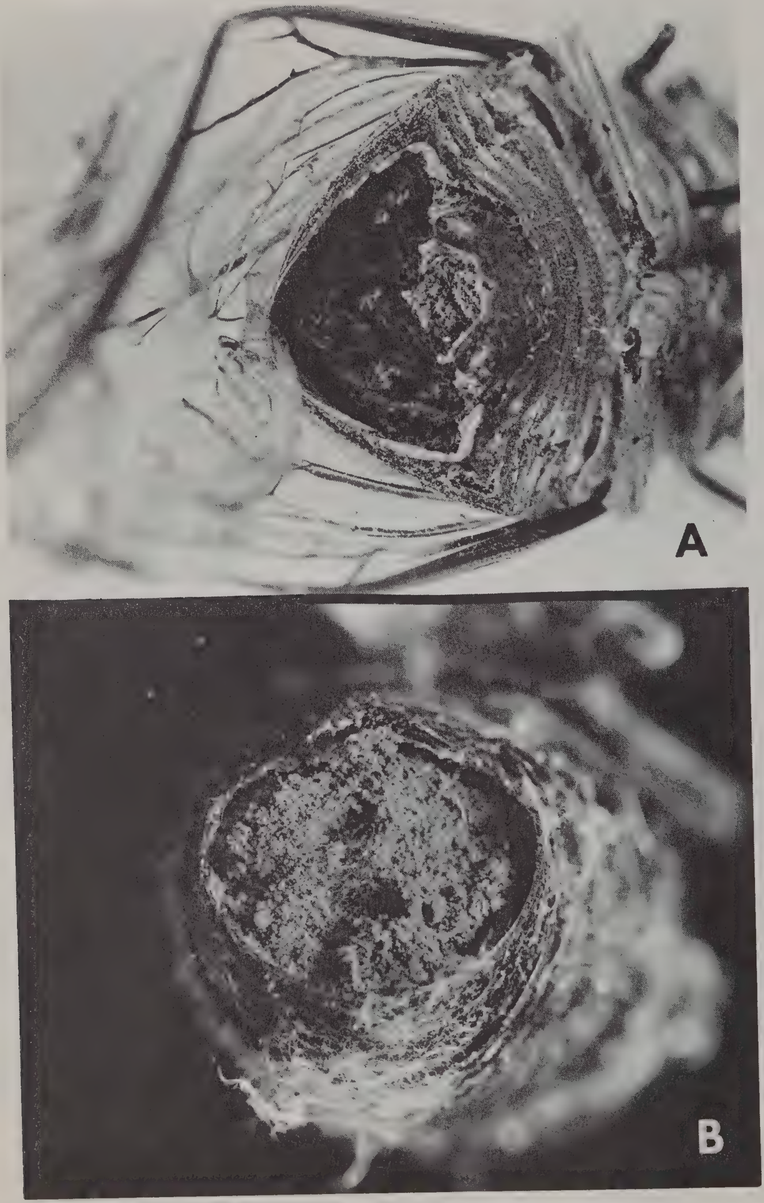

Figure 2. Cicadas infected with resting spore stage of *Massospora*: (A) *Quesada gigas* infected with *M. spinosa* 3 x; and (B) *Magicicada septendecim* infected with *M. cicadina* 4 x.

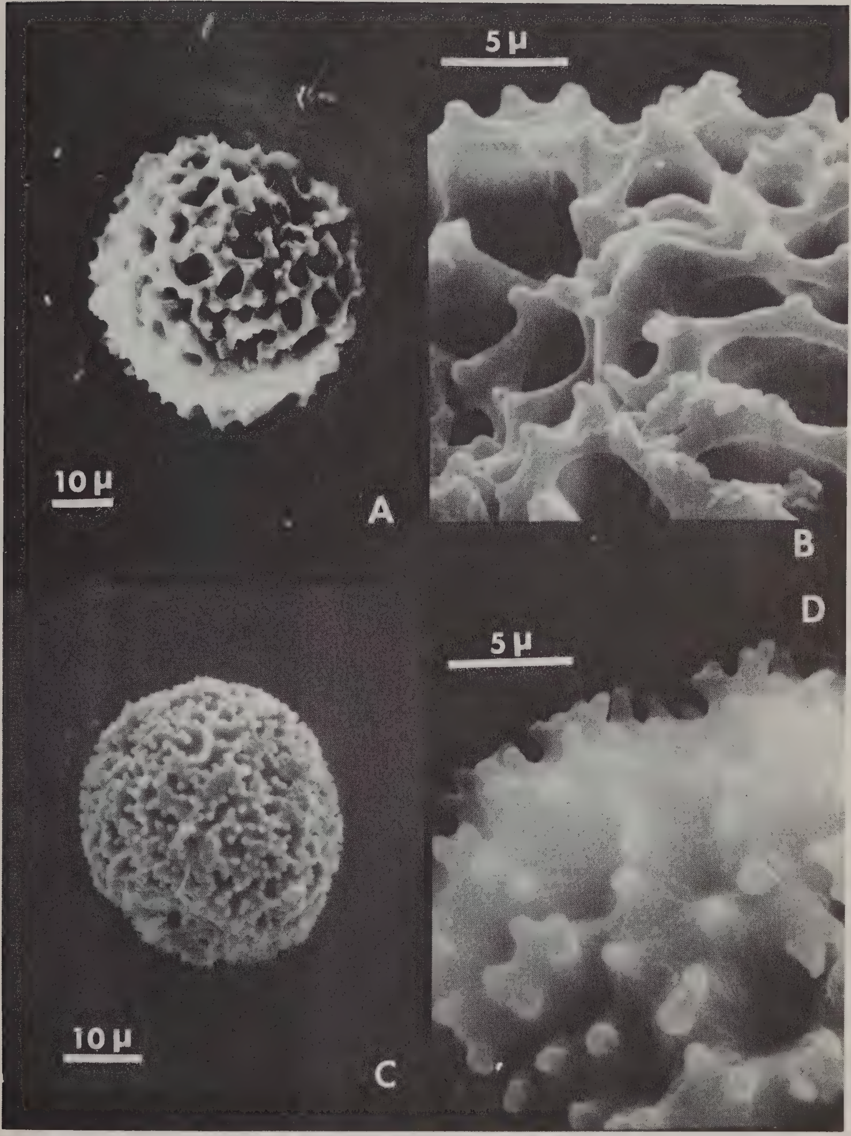
5 μ
10 μ
A
B
D
5 μ
10 μ
C

Figure 3. Scanning electron micrographs of resting spores: (A) and (B) *M. cicadina*; (C) and (D) *M. levispora*.

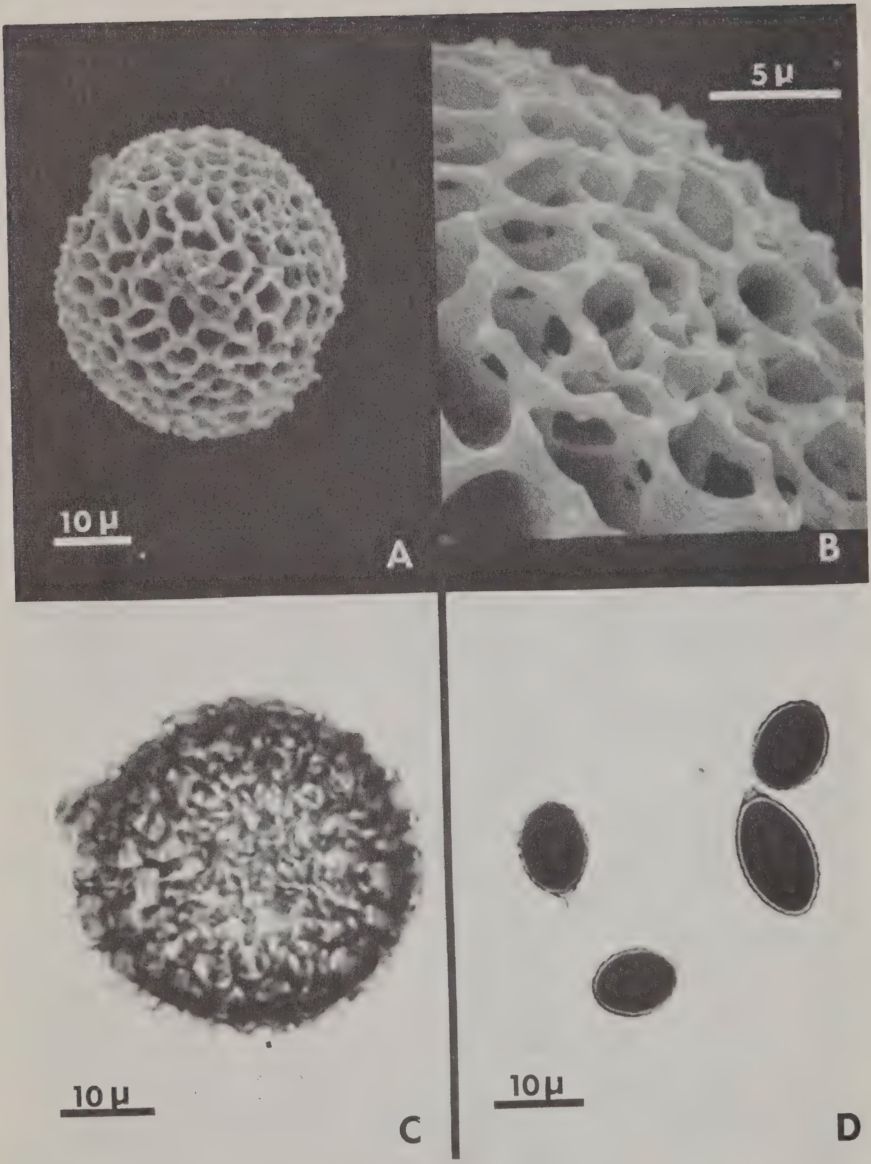
10 µ
A
5 µ
B
10 µ
C
10µ
D

Figure 4. Spore stages of *M. spinosa:* (A) and (B) scanning electron micrograph of resting spore; (C) resting spore as seen through light microscope; and (D) conidia.

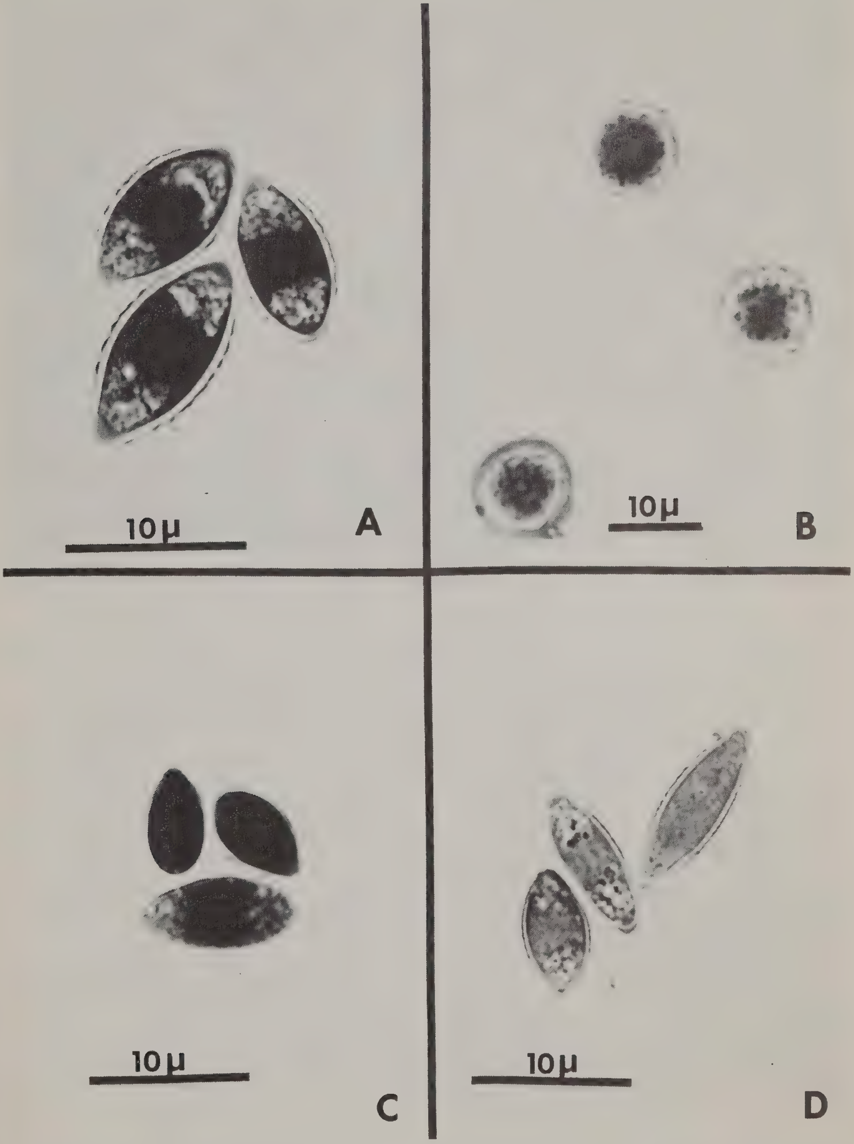
10µ
A
10µ
B
10µ
C
10µ
D

Figure 5. Conidial stages of *Massospora:* (A) *M. dorisiana;* (B) *M. carineta;* (C) *M. Platypedia;* and (D) *M. diceroprocta*

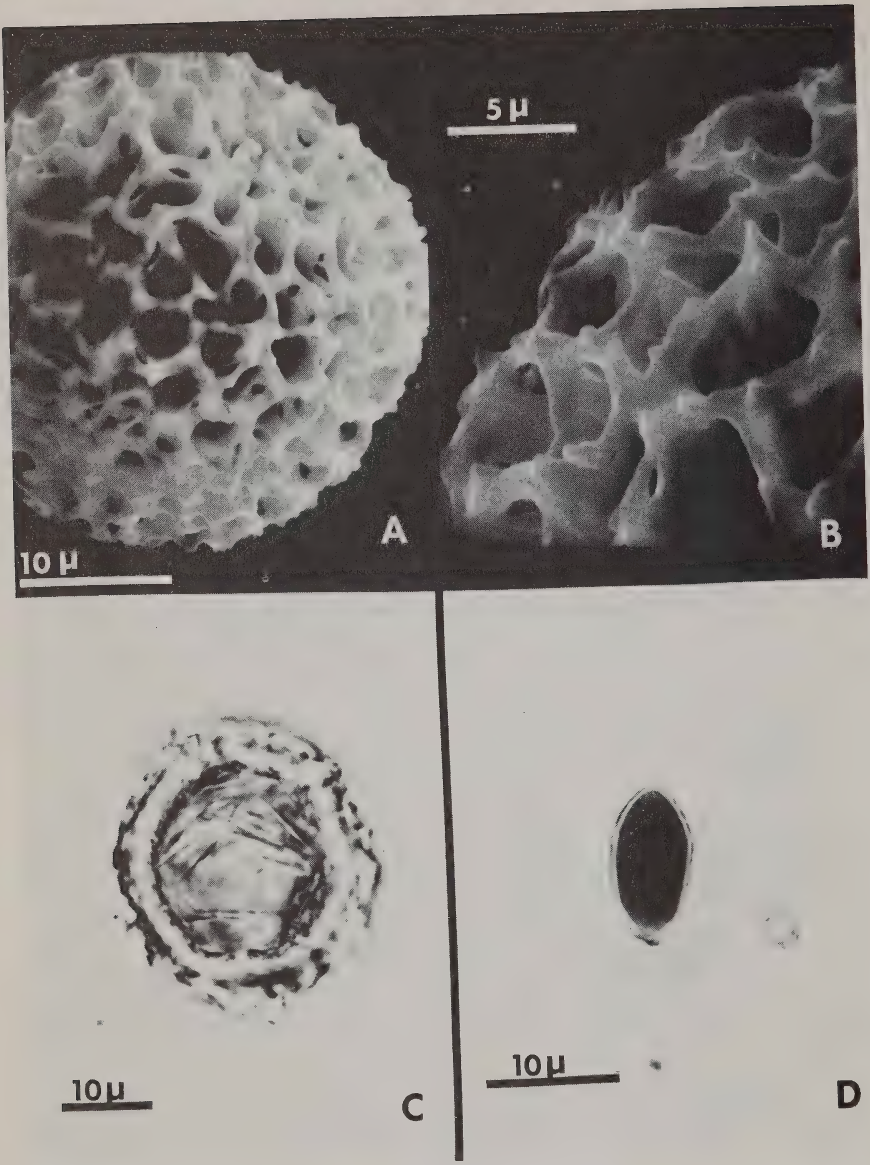
5 μ
10 μ
A
B
10μ
C
10μ
D

Figure 6. Spore stages of *M. ocypetes*: (A) and (B) scanning electron micrographs of resting spore; (C) resting spore as seen through light microscope; and, (D) conidia.

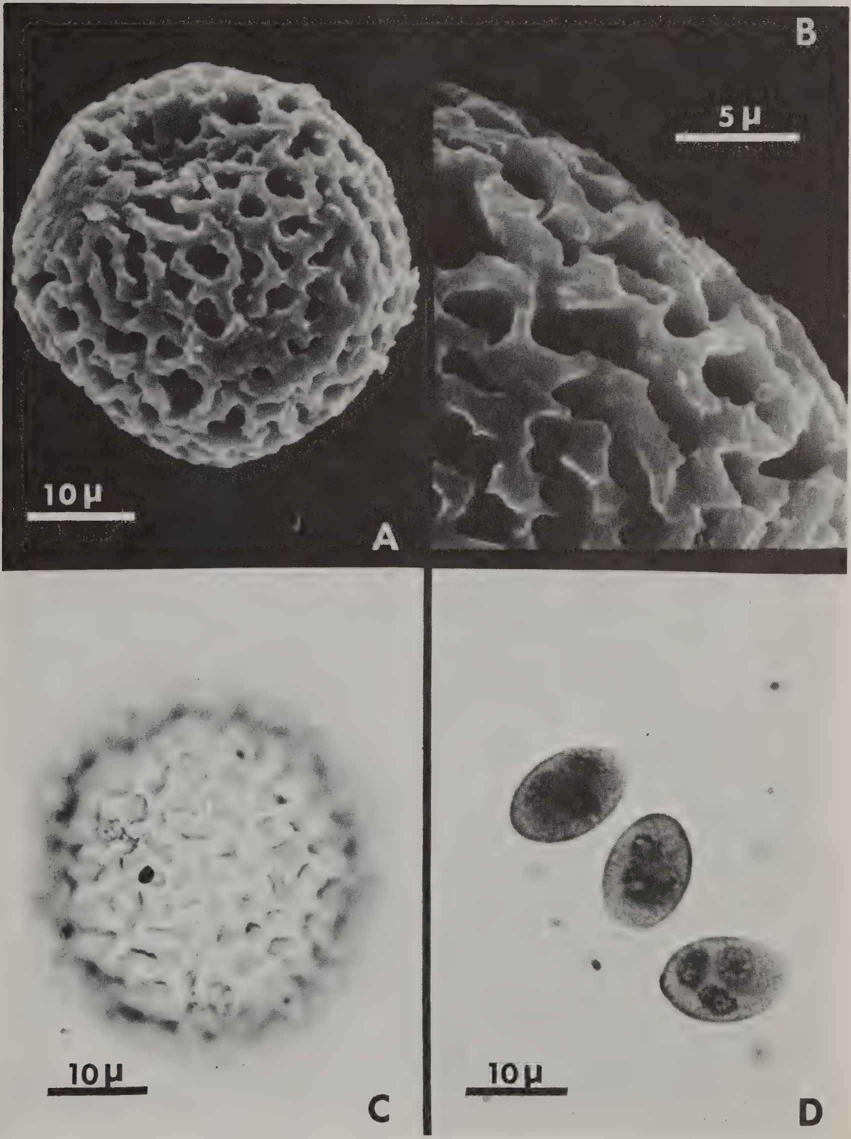
B
5 µ
10 µ
A
10 µ
C
10 µ
D

Figure 7. Spore stages of *M. tettigates*: (A) and (B) scanning electron micrographs of resting spore; (C) resting spore as seen through light microscope; and (D) conidia.

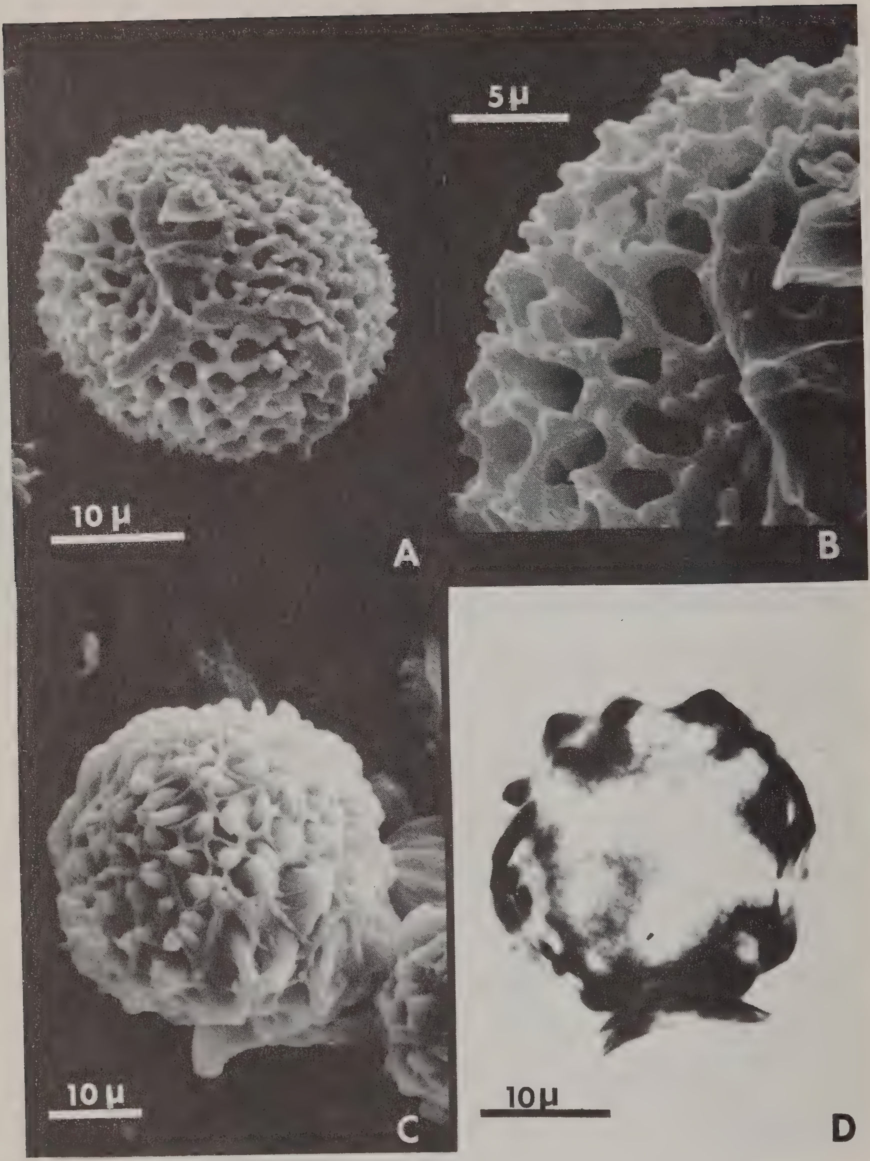

Figure 8. Resting spores: (A) and (B) scanning electron micrograph of *M. diminuta;* (C) scanning electron micrograph of *Entomophthora porteri* resting spore; and (D) appearance of *E. porteri* resting spore through light microscope.

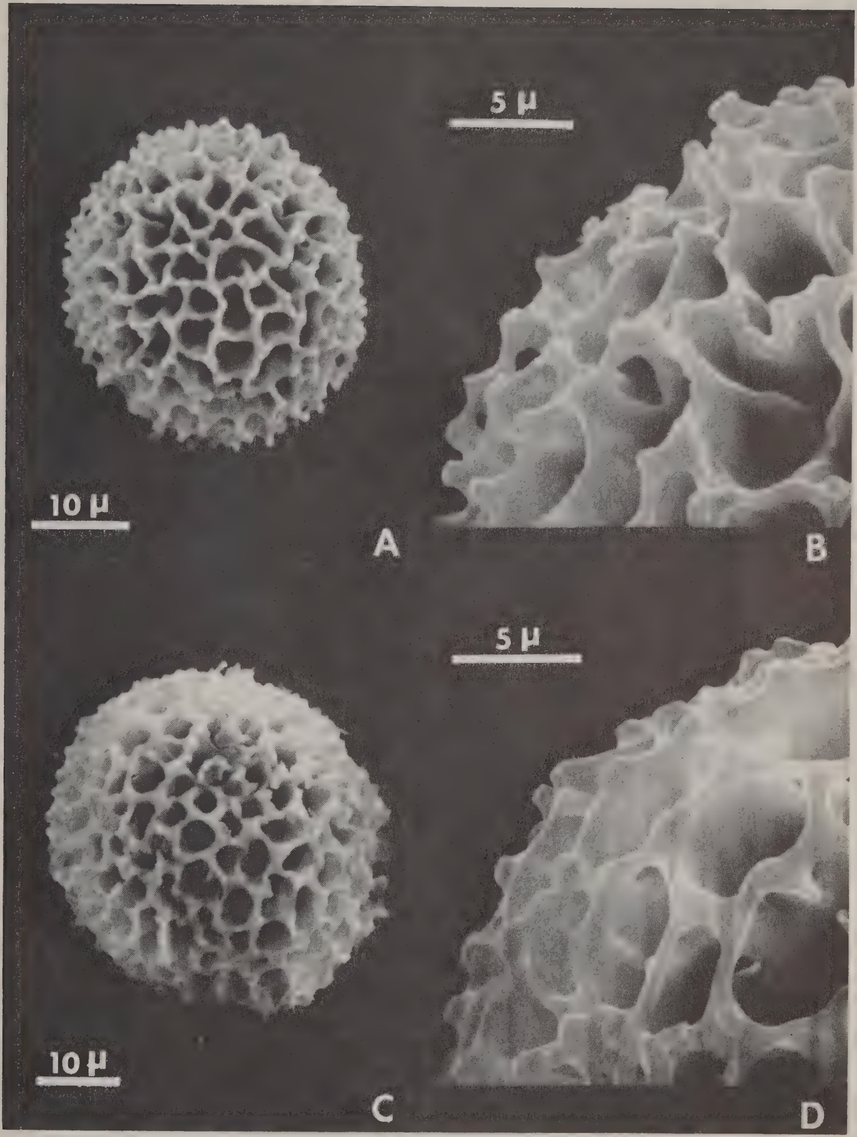
5 μ
10 μ
A
B
5 μ
10 μ
C
D

Figure 9. Scanning electron micrographs of *Massospora* resting spores from *Diceroprocta* spp.: (A) and (B) *D. biconica;* (C) and (D) *D. vitripennis.*

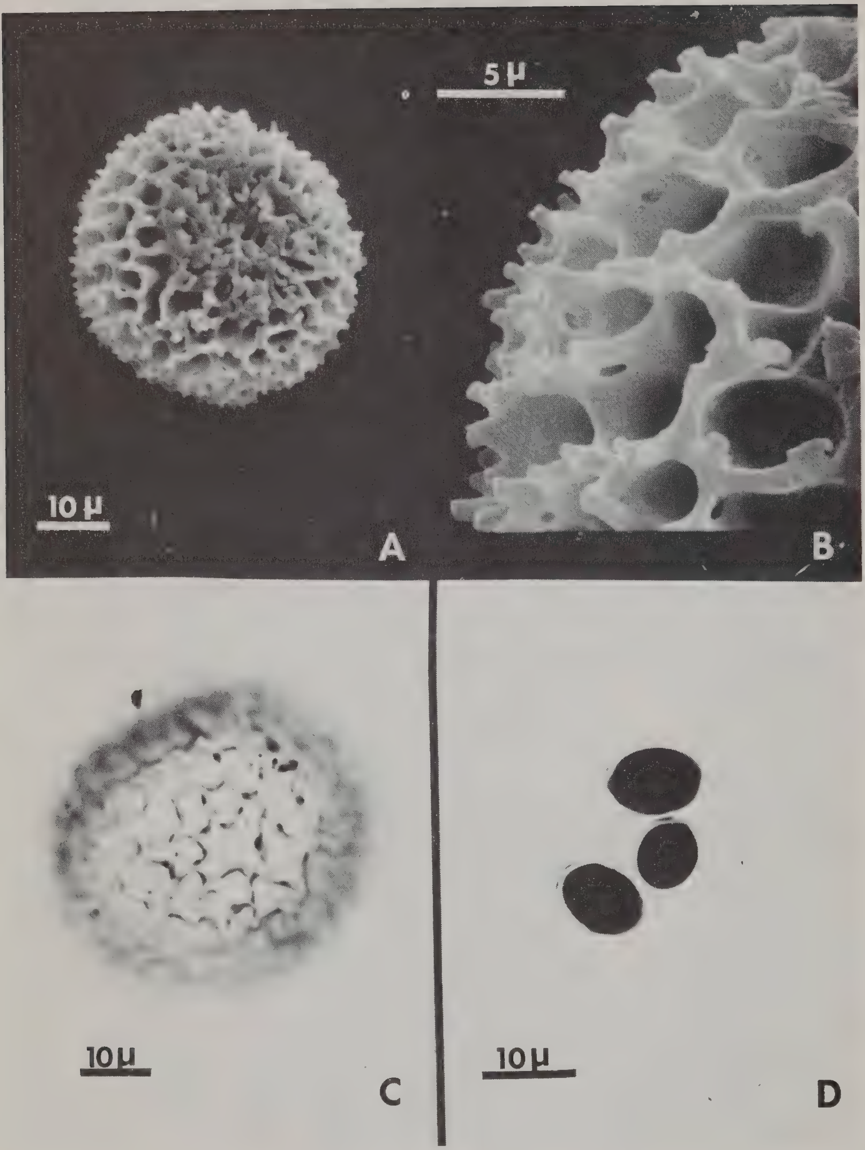
5 µ
10 µ
A
B
10µ
C
10µ
D

Figure 10. Spore stages of *M. fidicina*: (A) and (B) scanning electron micrographs of resting spore; (C) resting spore as seen through light microscope; and (D) conidia.

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TAXONOMIC STUDIES IN THE PHACIDIALES: STICTIS MARITIMA AND THE GENUS LASIOSTICTIS

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SUMMARY

The genus *Lasiostictis*, typified by *Lasiostictis conigena* (Sacc. & Berlese) Sacc., is sufficiently distinct from *Stictis*, *Coccomyces*, and *Naemacyclus* to be retained as a genus of the Phacidiaceae. *Stictis maritima* Rolland and *Stictis fimbriata* Schw. are synoymns. *Lasiostictis fimbriata* (Schw.) Bäuml. is the correct name for the only species in the genus.

Saccardo erected the genus *Lasiostictis* in 1889 to include the single species *L. conigena* (Sacc. & Berlese) Sacc. In doing so he raised the infrageneric taxon (rank not specified) of Saccardo and Berlese (1885) to generic rank. The species grows on cone scales of *Pinus* sp. and is distinguished from *Stictis* proper (sensu Saccardo) by its hairy margin. Rehm (1896) recognized that the species was probably synonymous with *Stictis fimbriata* Schw., based on North American material on cone scales of *Pinus*, but concluded that Saccardo and Berlese had mistaken the frayed edge of the apothecium for hairs and that no basis existed for segregating *S. fimbriata* from *Stictis*.

Petrak (1947) re-examined the species and observed that the asci were uniformly thin-walled and pointed apically, unlike those of *Stictis*. He chose to ignore the marked differences in excipular structure and suggested that *S. fimbriata* was no more than a growth form of *Naemacyclus niveus* (Pers.) Fckl., which grows on needles of the same host. The asci and spores of *N. niveus* indeed resemble those of *S. fimbriata* but this is scarcely sufficient reason for considering the two taxa conspecific. Although the hosts are the same, the substrates of the two fungi (needles and cone scales respectively) are quite dissimilar.

While examining collections of *Stictis* spp. made by R. P. Korf in Corsica, I encountered a specimen identified in the field as *Stictis maritima* Rolland. The species was originally described from there. The fungus agreed in all respects with Rolland's description and with a redescription by Müller and Hütter (1962) who transferred Rolland's species to *Coccomyces*. It was again reported from Corsica by Romagnesi (1973). The fungus grows immersed in cone scales of *Pinus maritima* L. and resembles a *Stictis;* the asci, however, are somewhat pointed and uniformly thin-walled, and there is a well-differentiated covering layer over the disc. When rehydrated the excipulum becomes reflexed, exposing the prominently hairy inner face of the covering layer. The reader is referred to the text of Müller and Hütter's article for a thorough redescription of *S. maritima*, the salient points of which are summarized above.

I rehydrated and examined superficially the material available in CUP, principally from the herbarium of E. J. Durand, of *Stictis fimbriata* Schw., and authentic material of *Lasiostictis conigena*. All specimens appeared under 25x magnification to have a more or less hairy margin. Schweinitz's type specimen and Saccardo's material contained so few apothecia that it did not seem advisable to section them, since published accounts of ascus and ascospore dimensions agreed with each other and with my observations on the other available material. Satisfactory sections of Korf's Corsican specimen, and collections by Sydow (Germany), Zahlbruckner (Hungary), and Ellis (USA) were obtained by imbedding in mucilage and sectioning at 20µm on a freezing microtome.

Maire(1930), commenting on *Lasiostictis fimbriata,* suggested that *Stictis maritima* was closely related. Judging both from the specimens examined and from Müller and Hütter's descriptions and figures, *Stictis fimbriata* and *S. maritima* are synonymous. The collections are variable in the extent of periphysoidal hair developement. Krieger's Fungi Saxonici *876* and Ellis's North American Fungi *72*, which Rehm examined, are less obviously hairy than the Hungarian or Corsican material, which may explain why Rehm, and other authors, for example Nannfeldt (1932), who examined specimens from northern Europe and North America, doubted that Saccardo and Berlese were justified in erecting the genus *Lasiostictis*.

Müller and Hütter's placement of *S. maritima* in the Phacidiales appears to be tenable, but there are numerous points of difference between it and *Coccomyces*. Figure 1 illustrates a detail of the marginal tissue of Zahlbruckner's Hungarian material. When the apothecium is closed, as in young or dry specimens, the hyphae of the covering layer have a definite vertical orientation. The ascus apex blues faintly in iodine and the spores do not appear to have a gelatinous coating. These three characters would refer *Lasiostictis* to the Phacidiaceae in the classification of Terrier (1942),rather than to the Hypodermataceae [=Rhytismataceae (Korf, 1973)] where *Coccomyces* is usually placed.

SYNONYMY.

Lasiostictis fimbriata (Schw.) Bäuml. *In* Ann. K. K. Naturh. Hofmus. Wien *XVI*. 1901. (N.V.)
- *Stictis (Lasiostictis) conigena* Sacc. & Berl. Atti Reale Ist. Veneto Sci., Lett., Arti VI *3:* p. 734. 1885.
- *Lasiostictis conigena* (Sacc. & Berl.) Sacc. Sylloge *8*, p. 696.1889.
- *Stictis fimbriata* Schw. Syn. Fung. Amer. Bor. p.179. 1834.
- *Stictis maritima* Rolland Bull. Soc. Mycol. France *14*, p.84. 1898.
- *Coccomyces maritimus* (Rolland) Müller & Hütter Rev. Myc. *27* p. 71. 1962.

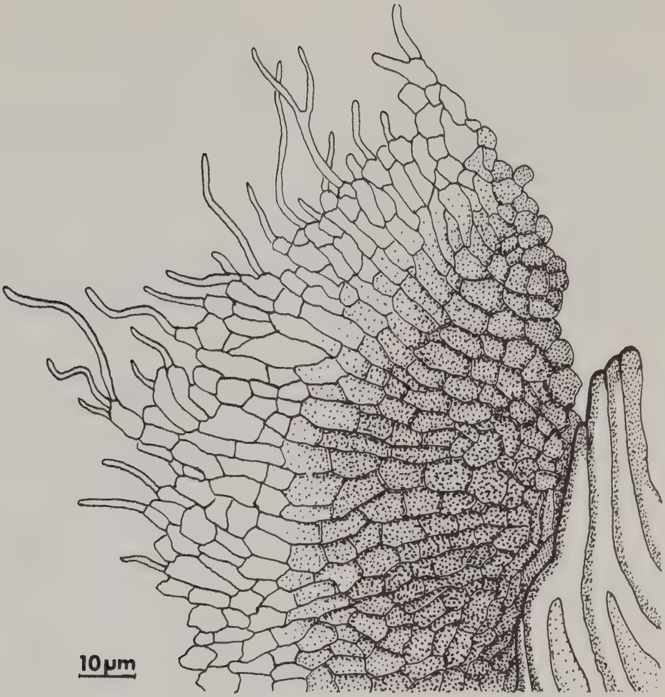

Figure 1. *Lasiostictis fimbriata.* Detail of margin. Drawn from CUP-D 107-47 with the aid of a Wild drawing tube.

Collections examined: As *Stictis maritima:* Corsica: on cone scales of *Pinus nigra,* Korf, 1972 (CUP *53244*); As *Lasiostictis conigena:* France: on cone scales of *Pinus sylvestris,* Hariot, 1906 (PAD); As *Stictis fimbriata:* Germany: on *Pinus sylvestris,* Sydow, Myc. Germ. *706*, (CUP-D *107-53*); Switzerland: On *Pinus sylvestris,* Krieger, Fungi Saxonici *1893* (CUP); Hungary: On cone scales of *Pinus sylvestris,* Zahlbruckner (CUP-D *107-47*); USA: On *Pinus,* Schweinitz, part of type (CUP-D *107-48*); on scales of pine cones, Ellis, N. A. F. (CUP-D *107-51*); on pine cones, Meschutt, (CUP *6693*).

The author wishes to thank Professor M. Orsenigo (PAD) for loaning specimens, and Professor R. P. Korf (CUP) for assistance in preparing the manuscript.

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MYCOTAXON

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LOMENTOSPORA PROLIFICANS, A NEW HYPHOMYCETE FROM GREENHOUSE SOIL

by

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Abstract

Lomentospora prolificans n. gen. n. sp., a new sympoduloblastic hyphomycete, originating from greenhouse soil in Belgium, is described. Its most distinctive feature is the long beaded rachis of its inflated conidiogenous cells.

This new hyphomycete has been isolated from greenhouse soil originating from mixed forest litter at Heverlee, Belgium, by plating soil suspensions on cellulose agar and keeping the plates for more than two months at room temperature.

The fungus is unusual in its clustured, flask-shaped conidiogenous cells prolongating in a long, nodulous or beaded, delicate rachis bearing numerous caducous conidia. None of the genera in the series of the sympoduloblastosporae appears to show such characters.

DESCRIPTION

Lomentospora gen. nov.

Hyphomycetes, sympoduloblastosporae. Hyphae hyalinae vel fuscobrunneae, septatae, ramosae, saepe aggregatae. Cellulae conidiogenae sympodiales, singulae vel catervatae, basipetaliter ex ramis vel cellulis hypharum efformatae, inflatae, lageniformes, proliferantes in apice in longa, flexuosa, nodulosa, tenue rachide simul cum successiva productione conidiorum. Conidia holoblastica, singula et successiva in apice rachidis ennata, ovoidea vel elliptica, sessilia vel in denticulis.

Species typica: *L. prolificans* spec. nov.

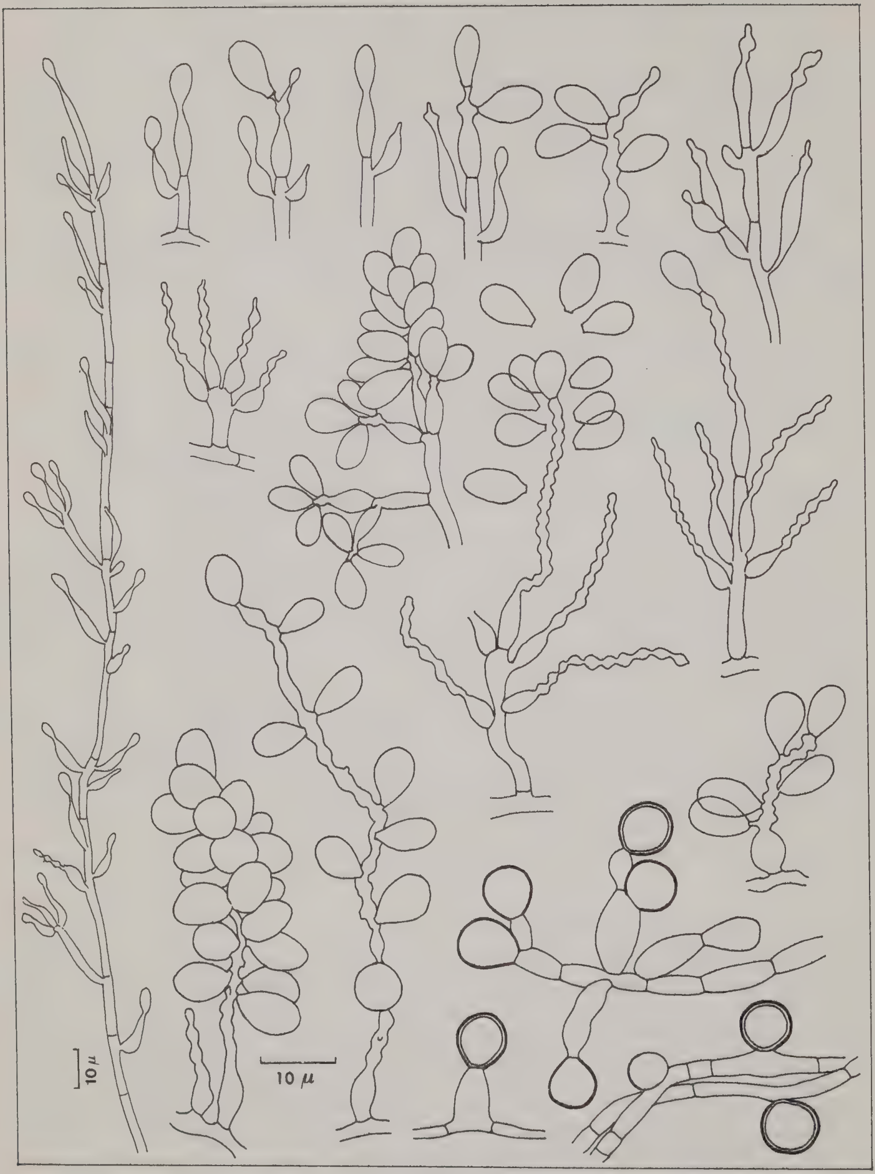

Fig. 1. *Lomentospora prolificans*. Fertile hypha, conidiophores, conidia and chlamydospores in type culture, × 500 and 1000.

Lomentospora prolificans spec. nov. (Fig. 1 & 2)

Coloniae moderate crescentes, primum griseoalbae, deinde griseobrunneae vel fuscobrunneae, copiose sporulantes, nigrescentes in reverso. Hyphae hyalinae vel fuscae, septatae, regulares, tenuitunicatae, 1-2 μ diam., singulae vel aggregatae. Conidiophori ex una vel pluribus cellulis conidiogenis basipetaliter successive productis in apice et lateralibus hypharum et brevium 8-20 μ ramorum. Conidiogenae cellulae sympodiales, inflatae, hyalinae, tenuitunicatae, 4-10x2-6μ, proliferantes in apice simul cum successiva et acropetale productione conidiorum, rachide usque 70 μ longa, flexuosa, nodulosa, 1-2 μ diam., cicatricibus conidiorum saepe obscuris, non incrassatis. Conidia holoblastica, singula in apice rachidis successive ennata, spicatim disposita, ovoidea vel elliptica, 5-10 × 4-6 μ, attenuata ad basile septum, pallide brunnea, crassotunicata, levia, saepe cum minuto fragmento denticulorum rachidis. Chlamydospora in substrato formata ex abnormale conidiogenese, globosa, usque 8 μ diam., brunnea, crassotunicata cum lato basale septo.

Habitat in viridicarii humo, e sylvario humo composito, Heverlee, Belgio. Typus siccus in herbario G.L.H.18141 et vivens in MUCL 18141, Universitate lovaniense; isotypus in CBS 467.74, Baarn.

Colonies relatively slow growing, 2.5-4.5 cm diam. in 12 days depending upon the nutrient, prostrate or fluffy, white to gray white when young, turning quickly grayish brown to dark brown when sporulating, reverse pale to black with some shades of mauve or blue. Hyphae hyaline to light brown, septate, regular, thin-walled, narrow, 1-2 μ diam., single or aggregated in creeping or aerial strands. Conidiophores composed of one or more conidiogenous cells developed successively and basipetally, either on short, 8-20 × 1.5-3 μ, lateral branches of the hyphae or from the distal end or the sides of the terminal and intercalary cells of the same hyphae. Conidiogenous cells sympodial, flask-shaped, hyaline, thin-walled, narrowing at the tip, varying in size, small in poor culture media, larger in rich ones, 4-10 x 2-6 μ; proliferating, after the production of the first apical conidium, successively and acropetally with the production of each new conidium by swelling and budding at a point close to the attachment of the previous conidium, forming a long, delicate, flexuous rachis, up to 70 μ in length, 0.8-1.5 μ in width, sometimes geniculate, but most commonly showing regular swellings up to 2 μ diam. at the point of proliferation of the axis near the attachment of the conidia, with scars of conidial attachment wide, sometimes prominent as a denticle, but most often inconspicuous. Conidia holoblastic , numerous, borne singly but successively at the apex of the conidiogenous cell, from a long pedicellate bud, ovoid to elliptical, narrowing and truncate at the 1.5-2 μ wide basal septum, relatively thick-walled, light brown, smooth, dry, caducous, sometimes with a frill of the conidiogenous

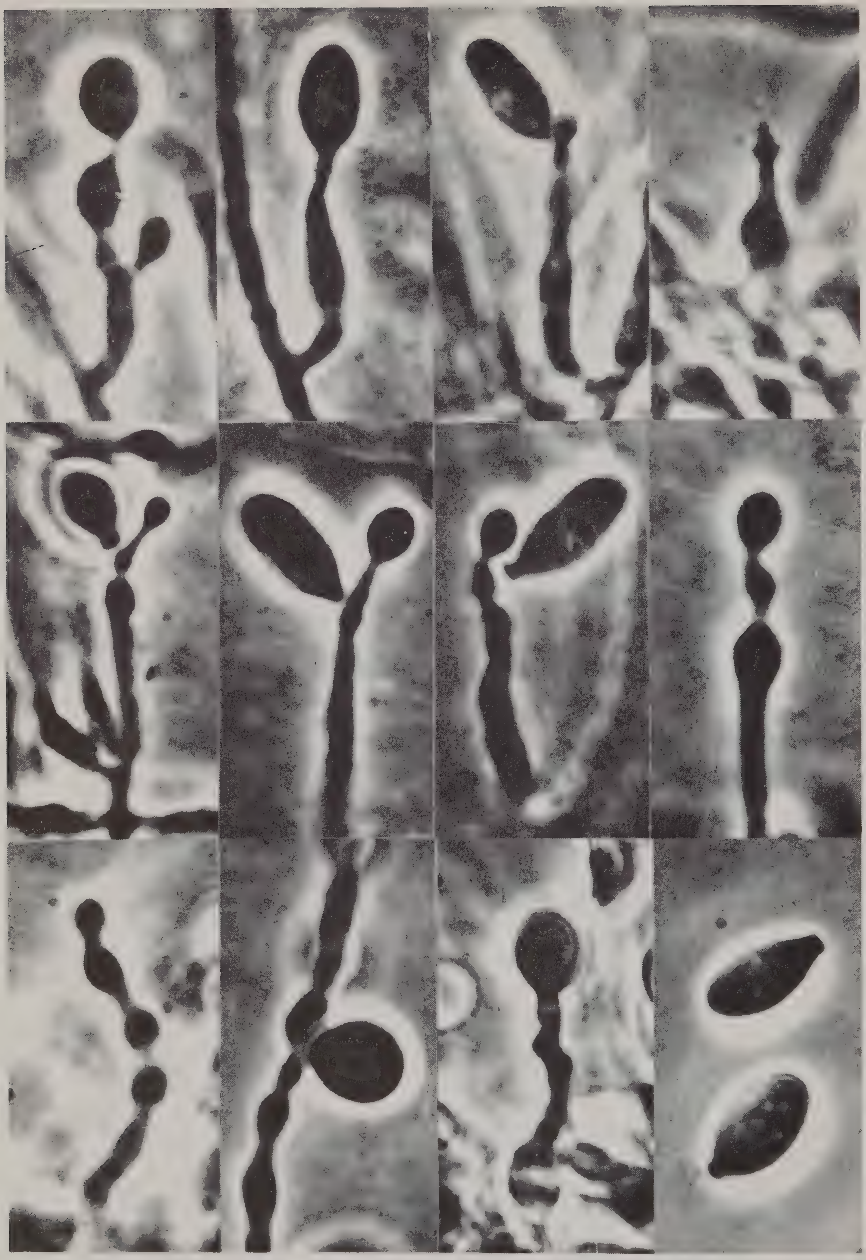

Fig. 2. *Lomentospora prolificans* . Conidial development, from type, × 2000.

cell at the base. Atypical conidia turning to chlamydospores, developed in the substratum, either on atypical conical, globose or flask-shaped, stipitate or intercalary conidiogenous cells or directly on the hyphal cells, globose, up to 8 µ diam., thick-walled, dark brown, smooth, with a wide basal septum.

No perfect state known.

Habitat in greenhouse soil, prepared from mixed forest litter, Heverlee, Belgium. Type in Herb. G.L.H. 18141 and as living culture MUCL 18141, in the culture collection of the University of Louvain; isotype in CBS 467.74, Baarn.

Cultural characteristics at room temperature after 12 days (*):

(a) on 2 % PDA, 1-10 % MA or MYA, 4 % MDPA, 1 % GCNA : colonies 2.5-3.0 cm in diam.; surface zonate, plain, velvety, with center effuse to funiculose, mouse gray to avellaneous gray or dark olivaceous, gray brown to brown when dried; heavily sporulating; showing light coloured sectors; submerged hyphae narrowly zonate and radiate, olivaceous; margin irregular, thin, submerged, translucent; reverse olivaceous black to blue black.

(b) on 1-4 % DYAA: colonies 3.5 cm in diam. with abundant mycelial growth; surface effuse to lanose, zonate, light to dark mouse gray, center darker; moderately sporulating; margin thin, whitish gray to olivaceous; reverse olivaceous black.

(c) on 2 % PSA, CZA, CPA, CMCA, CFA, OA : colonies 2.5 cm in diam., reaching 4.5 cm on OA; translucent to milky, with aerial hyphae absent or scanty and white on CZA, PSA and CPA, tufted, whitish and turning mouse gray with some conidial production on CMCA, CFA and OA; margin wavy, thin; reverse orange gray to greenhish gray; zone clearing in the medium around the colonies on PDA and CPA.

The soil isolate of the fungus grows well and sporulates on most of the media except on CZA, CPA and PSA. On these culture media, scattered white floccose hyphal masses have appeared which on subculturing in 2 % MYA maintained their white appearance. On the other media, sectors are also observed, which on cultivation on various media produce lighter coloured or almost white tufted colonies.

DISCUSSION

Lomentospora prolificans is remarkable for its produc-

(*) MYA, malt agar with yeast extract; **MDPA, malt dextrose** peptone agar; GCNA, glycerol caseine nitrate agar; DYAA, dextrose yeast asparagine agar; PSA, potato sucrose agar; CZA, Czapeck agar; CPA, carrot potato agar; CMCA, carboxymethylcellulose agar; CFA, cellulose fiber agar; OA, oat agar; percentages indicating the sugar contents.

tion of numerous conidia on a long, delicate, beaded, lomentum-like rachis of the conidiogenous cell.

The new genus *Lomentospora* is distinguished from other genera of the sympoduloblastosporae by the following features: (1) the basipetal production of successive conidiogenous cells on a hyphal branch or a hyphal cell; (2) the lageniform body of the conidiogenous cell; (3) the long flexuous, narrow rachis, prolongating the conidiogenous cell; (4) the beaded, lomentum-like form of the rachis, which results from the swelling of the new growing point producing the new conidial bud; (5) sometimes evident but often obscure unthickened denticles on the rachis; (6) the coloured, ovoid conidia; (7) the caducity of the conidia.

One of the most related genera appears to be *Beauveria* Vuill., with its flask-shaped conidiogenous cells arising in a cluster on a common supporting cell. But *Beauveria* obviously differs from *Lomentospora* by the typical zig-zag form of its rachis (De Hoog, 1972).

Similarly, *Tritirachium* Limber shows slightly inflated conidiogenous cells, with a zig-zag rachis bearing no prominent scars or cicatrices. *Rhinocladiella* Nannf. shows a relatively short rachis ornamented with narrow unthickened denticles. The absence of thickened denticles is also observed in *Geniculisporium* Chesters & Greenhalgh and in *Raffaelea* v.Arx & Hennebert, in which the conidium is delimited by a relatively wide basal septum; but the resulting rachis still shows a zig-zag formation.

In *Lomentospora*, the rachis is regularly knotty or beaded, swollen more or less at regular intervals. The development of these swellings can be explained by the concentration of active cytoplasm, recognized by its cyanophilic character, in the new growing point at the apex of the conidiogenous cell. These swellings are evidence of the successive conidiogenous loci of the sympodial conidiogenous organ.

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BISPORELLA, A GENERIC NAME FOR HELOTIUM CITRINUM AND ITS ALLIES, AND THE GENERIC NAMES CALYCELLA AND CALYCINA

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SUMMARY

A nomenclatural study on typification of the generic name *Calycella,* used for several common yellow species of "*Helotium*" in recent treatments, led to discovery that the year-older name *Bisporella* ought to be adopted for it. *Calycella* must also be abandoned for another reason: it is a nomenclatural synonym of the much older name *Calycina;* both are typified by *Peziza herbarum,* a species not closely related to *Helotium citrinum* and presently treated in *Hymenoscyphus.* New combinations are proposed for the type species of *Bisporella,* now to be called B. pallescens instead of *B. monilifera,* and for B. citrina, B. sulfurina, and B. strumosa.

I. CALYCELLA AND CALYCINA

A. *Assignment of Helotium citrinum to the genus Calycella sensu Boudier*

One of the most common, small yellow Discomycetes occurring in large numbers on rotting wood and branches throughout the temperate regions was for many years called *Helotium citrinum* (Hedw. ex Purton) Fr. The Discomycete generic name *Helotium* Pers. ex St.-Amans, accepted by Fries (1822) only at an infrageneric level, competes with the Basidiomycete generic name *Helotium* Tode ex Leman, which was later accepted by Fries (1832). The Discomycete name must necessarily be abandoned (Dennis, 1962, 1964; Donk, 1962).

The microanatomical structure of the apothecia of *Helotium citrinum* is unlike that of species of either of the two genera that now have replaced *Helotium: Hymenoscyphus* and *Cudoniella.* The ectal excipulum is composed of gelatinized hyphae or of hyphae embedded in a gelatinous matrix, running at an angle almost perpendicular to the outer surface. Though a few authors (*e.g.*, Seaver, 1951; Kursanov, 1954; Naumov, 1964) have retained this species in *Helotium,* in most modern classifications it has instead been regularly referred to the genus *Calycella,* as *C. citrina* (Hedw. ex Purton) Boud. (Boudier, 1885, 1907a, 1907b; Quélet, 1886; Le Gal, 1938, 1953; Grelet, 1947; Ramsbottom and Balfour-Browne, 1951; Dennis, 1956, 1960, 1968; Svrček, 1962; Moser, 1963; Berthet, 1964;

Svrček and Kubička, 1964; Thind and Saini, 1967; Raĭtviĭr, 1968; Gamundí, 1971; Korf, 1973). The genus *Calycella* has been referred to the Ombrophilaceae (Boudier, 1885, 1907a; Le Gal, 1938; Grelet, 1947), to the Helotiaceae subf. Helotioideae (Le Gal, 1953; Dennis, 1960, 1968), to the Helotiaceae subf. Phialeoideae (Dennis, 1956), and to the Leotiaceae subf. Hymenoscyphoideae (Korf, 1973).

B. *Typification of Calycella*

When Boudier (1885) created the genus *Calycella,* he referred to it as "*Calycella* (Fr.)," with the observation, "Parmis les plus connus je citerai: *C. citrina* Batsch, *sulfurina* Quél." The citation of Fries as authority for the genus leaves no doubt that Boudier merely raised *Helotium* [sect.?] *Calycella* Fries (1849) to generic rank, and that one of Fries's original species ought to be selected as the lectotype of the infrageneric taxon and its derived genus. While it would seem that *C. citrina* is a logical choice [since *C. sulfurina* (Quél.) Boud. was not in Fries's treatment], we are not forced to select either of the species Boudier mentioned (he named only two of the most common species he intended to include), but rather we should look to those included by Fries.

Close examination of Fries's 1849 publication discloses that *Helotium* [sect.?] *Calycella* is an avowed substitute and merely a renaming of his own (Fries, 1822) *Peziza* 'tribus' *Calycinae,* to which clear reference is made. Comparison of the two taxa reveals that these are essentially parallel. Moreover, Fries's *Calycinae* is in turn based upon Nees von Esenbeck's (1817) *Peziza* stirps *Pezizae pedicellatae* 'familia' *Calycinae,* unequivocal reference to that treatment being given by Fries (1822). Boudier's genus, as well as Fries's section (?) and earlier 'tribus' are thus all tied back to Nees's original taxon, which contained but four species, from among which a type should be selected.

Helotium [sect.?] *Calycella* was apparently first lectotypified by Höhnel (1918), who designated *Peziza herbarum* (Pers. ex Gray) Pers. as the type. This is, perhaps only by chance, one of Nees's original species, and was a member of both Fries's 'tribus' *Calycinae* and his section (?) *Calycella.* So far as we are aware, no author has yet designated a lectotype species for *Calycella* (Fr.) Boud. at the generic level, but Höhnel's typification is binding at any rank.

There are two other Discomycete genera published later, with the same name. When Quélet (1886) used the generic name *Calycella,* he attributed it to himself, not mentioning either Fries or Boudier. His genus included many species of diverse relationships by today's standards; to the best of our knowledge it has never been lectotypified. We hereby designate *C. pallescens* (Pers. ex Gray) Quél. as the lectotype of this later homonymic name. The third genus bearing the same name is *Calycella* (Sacc.) Sacc. in Sacc. & Syd. (Saccardo, 1899). This is based upon *Helotium* subg. *Calycella* Saccardo (1889) which has no obvious taxonomic relationship to either Boudier's or Quélet's genus. Saccardo's generic name was lectotypified by Clements and Shear (1931) with *C. alutacea* (Berk. & Br.) Sacc. ex Clem. & Shear.

C. *The genus Calycina sensu Seaver*

S. F. Gray (1821) took the same 'familia' *Calycinae* of Nees (1817) mentioned above, and created a genus of it, *Calycina* (Nees) ex Gray. He included two of Nees's four original species [*C. pallescens* (Pers.) ex Gray and *C. herbarum* (Pers.) ex Gray] and added three others. This generic name remained almost forgotten until revived by Otto Kuntze (1898), whose treatment was ignored by other authors. Seaver (1934, 1942, 1951) later used it for a group of species now placed in the Sclerotiniaceae, which White (1941) referred to *Rutstroemia*. Seaver (1934) chose *C. firma* (Pers.) ex Gray as the type species, following the American Code's first-species rule. That species is, however, ineligible, as Dumont (1972) has pointed out, since it was not one of Nees's original species, and Gray had attributed the generic name to Nees. None of the original species appear to be Sclerotiniaceous, and the name *Calycina* therefore cannot be used in the sense of Seaver.

D. *Typification of Calycina*

The only valid typification of *Calycina* that we have been able to discover is that by Dumont (1972), who designated *Peziza herbarum* as the type. This same species is, as noted above, also the lectotype species of *Calycella* (Fr.) Boud. Both generic names are tied not only by their nomenclatural history, but by the fact that both (perhaps fortuitously) have the same lectotype species. *Calycella* (Fr.) Boud. 1885 is necessarily a later nomenclatural synonym of *Calycina* (Nees) ex Gray 1821.

The genus *Calycina*, typified by *C. herbarum*, is certainly not a taxonomic synonym of the genus *Calycella* as Boudier and more recent authors have conceived it. *Calycina herbarum* is treated by such authors in *Hymenoscyphus* (or *Helotium*), and is characterized by thin-walled, brick-shaped excipular cells running parallel to the outer surface, with an absence of gelatinized walls. Most taxonomists will probably continue to treat *Calycina* merely as a synonym of *Hymenoscyphus*. Since both generic names date from the same work (Gray, 1821), they were intentionally synonymized by Dumont (1972) and *Hymenoscyphus* chosen as the correct name for such a combined genus. When and if *Hymenoscyphus* is successfully broken into smaller and more natural genera, *Calycina* could be revived for a segregate genus with species allied to *C. herbarum*, while *Hymenoscyphus* would be restricted to species more closely related to its type species, *H. fructigenus* (Pers. ex Mérat) Gray.

E. *A partial synonymy for the generic name Hymenoscyphus*

In order to place both *Calycina* and *Calycella* (Fr.) Boud. in their present taxonomic synonymy with *Hymenoscyphus*, we provide here a partial synonymy covering only these and early synonyms. Some later-described genera doubtless also belong in the synonymy, but are not considered here.

HYMENOSCYPHUS (Nees) ex Gray, Nat. Arr. Brit. Pl. 1: 673. 1821 [Nees not cited, a *lapsus calami*[1]; lectotype species: *Hymenoscyphus fructigenus* (Pers. ex Mérat) Gray, provisionally and later formally designated by Dennis (1962, 1964)].

≡ [*Peziza* "Pers." 'familia' *Hymenoscyphi* Nees, Syst. Pilze und Schwämme, Ueberbl. 71. 1817 (devalidated: pre-starting point; also rank misplaced, Art. 33).]

≡ *Peziza* L. ex St.-Amans 'trib.' *Hymenoscyphae* (Nees ex Gray) Fr., Syst. mycol. 2(1): 116, 117. 1822 (valid, despite misplaced rank, exception to Art. 33); non *Peziza* [sect.?] a. *Hymenoscyphae* Fr., Summa veg. Scand., sect. post. 353. 1849 (excludes all of Nees's original species).

≡ *Peziza* L. ex St.-Amans subg. *Hymenoscypha* (Nees ex Gray) Berk., Smith's Engl. Flora 5(2): 200. 1836.

≡ *Hymenoscypha* (Nees ex Gray) Phill., Man. Brit. Discom. 111. 1887 (ut "Fries").

≡ *Helotium* Pers. ex St.-Amans [subg.?] B. *Hymenoscypha* (Nees ex Gray) Rehm, Rabenh. Kryptogamenfl. Deutschl., Oesterr. Schweiz II 1(3)[39]: 781. 1893; non *Phialea* (Fr. ex Fr.) Gill. [subg.?] B. *Hymenoscypha* Sacc., Syll. fung. 8: 270. 1889.

= [*Peziza* "Pers." 'familia' *Calycinae* Nees, Syst. Pilze und Schwämme, Ueberbl. 69. 1817 (devalidated: pre-starting point; also rank misplaced, Art. 33).]

≡ *Calycina* (Nees) ex Gray, Nat. Arr. Brit. Pl. 1: 669. 1821 [lectotype species: *Calycina herbarum* (Pers.) ex Gray, designated by Dumont (1972)].

≡ *Peziza* L. ex St.-Amans 'trib.' *Calycinae* (Nees ex Gray) Fr., Syst. mycol. 2(1): 116, 128. 1822 (valid, despite misplaced rank, exception to Art. 33).

≡ *Peziza* L. ex St.-Amans subg. *Calycina* (Nees ex Gray) Berk., Smith's Engl. Flora 5(2): 202. 1836.

≡ *Helotium* Pers. ex St.-Amans [sect.?] b. *Calycella* Fr., Summa veg. Scand., sect. post. 355. 1849 [a name change, and avowed substitute; lectotype species: *Helotium herbarum* (Pers. ex Gray) Fr., designated by Höhnel (1918)].

≡ *Helotium* Pers. ex St.-Amans subg. *Calycella* (Fr.) Sacc., Bot. Centralbl. 18: 217. 1884; non *Helotium* subg. *Calycella* Sacc., Syll. fung. 8: 248. 1889 → *Calycella* (Sacc.) Sacc. in Sacc. & Syd., Syll. fung. 14: 31. 1899.

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[1] Gray (1821) clearly raised Nees's 'familia' names to generic rank, *e.g.*, *Calycina* (Nees) ex Gray, *Dasyscyphus* (Nees) ex Gray, *Macroscyphus* (Nees) ex Gray are the three genera immediately preceeding *Hymenoscyphus* in Gray's treatment. The lack of a reference to Nees for this one generic name is surely a typographical error. Even the order was the same in Nees's work: *Calycinae*, *Dasyscyphi*, *Macroscyphi*, *Hymenoscyphi*.

≡ *Calycella* (Fr.) Boud., Bull. Soc. Mycol. France 1: 112. 1885; non *Calycella* Quélet 1886, nec *Calycella* (Sacc.) Sacc. in Sacc. & Syd. 1899.

II. BISPORELLA

A. *The generic name Bisporella replacing Bispora Fuckel non Corda*

Fuckel (1870) found a yellow Discomycete growing amongst a dematiaceous mould, and concluded that one was parasitic on the other or that the two represented states of the same organism. He identified the mould correctly as *Bispora monilioides* Corda, with its characteristically 2-celled conidia. Septate ascospores are unusual among the species Fuckel ranged in his Pezizei. "Wie erstaunte ich aber, als ich zu Hause die Schlauchsporen unter dem Mikroskop sah!" was his response to noting 2-celled ascospores. Rather than creating a new generic name for the Discomycete, Fuckel "emended" Corda's genus *Bispora* and transferred it to the Ascomycetes. He named the Discomycete *Bispora monilifera* Fuckel, retaining the name *B. monilioides* for the imperfect state. Since the type of Corda's genus was a member of the Dematiaceae, and hence without ascospores, such a transfer is not permitted under the present Code of Nomenclature (Art. 59). [This was not the first time that such a transfer was attempted, however, since the brothers Tulasne (1865) had similarly "converted" the stilbaceous genus *Coryne* into a Discomycete, not corrected until Groves and Wilson (1967) proposed *Ascocoryne* for the ascigerous state.]

Saccardo (1884) recognized that Fuckel was incorrect in attempting to emend Corda's genus, and proposed the generic name *Bisporella* Sacc. for the discomycetous portion of the life cycle. Fuckel's genus *Bispora* may have been adopted only twice subsequently, by Fuckel (1871) and by Lambotte (1887, fig. 58). Saccardo's generic name has also seen little use except by Bommer and Rousseau (1884, 1891), Saccardo (1889), Mussat (1901), and as a subgenus of *Helotium* by Lindau (1897).

B. *Bisporella, a taxonomic synonym of Calycella sensu Boudier*

Bisporella monilifera (Fuckel) Sacc. is the only species to have been placed thus far in the genus. Though *Bisporella* has not infrequently appeared in synonymies under the generic name *Helotium*, it was not until 1956 that Dennis recognized that the Fuckel species is congeneric with *Calycella citrina*. Dennis (1956) transferred the species, providing the combination *C. monilifera* (Fuckel) Dennis. Neither in that paper, nor in later publications (Dennis, 1960, 1964, 1968) does he indicate why he failed to adopt the generic name *Bisporella* Sacc. 1884, having a year's priority over *Calycella* (Fr.) Boud. 1885, the name he accepted.

Unfortunately Dennis (1956) transferred Fuckel's epithet, and did not adopt a much older epithet known to him. In his discussion of *C. monilifera,* Dennis has a rather long series of comments on *Peziza pallescens* Pers. He noted that Persoon (1799) had merely renamed *Peziza lenticularis* Hoffman (1795), which "is clearly the fungus which has commonly been called *Helotium moniliferum.*" Dennis did not adopt "the epithet *pallescens* Pers., however, because the fungus preserved under that name in Persoon's herbarium (No. 910.261-396.90 O.H.) is something quite different."

We agree that Hoffman's figure is unmistakably the same fungus that Fuckel described. We also agree that Persoon (1799) did not erect a new species, but only provided a new name for *P. lenticularis* Hoffm., which he cited as a synonym of his new name, *P. pallescens.* He was avoiding homonymy with the next species he described, *P. lenticularis* Bull. We hold, therefore, that one should first search for a Hoffman specimen to typify the species which Persoon renamed.

Since Hughes (1958) noted that he had examined the type specimen of *Dematium antennaeforme* Hoffm. (the conidial fungus illustrated as accompanying *P. lenticularis* Hoffm.), we obtained the two Hoffman specimens under this name from the Berlin Botanisches Museum to see if there were any apothecia present, or if there was material filed there under *P. lenticularis.* No material was discovered there under the Discomycete name, and the two packets we did examine of Hoffman's *Dematium* are unfortunately devoid of apothecia.

We next turned to the Persoon herbarium, at Leiden. Merely because a specimen is present there does not automatically make such a specimen a Persoon type, however, since we are informed by Dr. R. A. Maas Geesteranus of the Leiden Rijksherbarium that many of the collections there represent material collected late in Persoon's career, during his stay at Paris. The specimen referred to by Dennis had apparently been erroneously placed in the cover of *Peziza lenticularis* Bulliard [sic]. It bears the label: "*Peziza ? lenticularis* Hoffm. — *pallescens.* Syn. pl." but bears no date or indication of when or where it may have been collected. We agree with Dennis's conclusion that this specimen does *not* represent the fungus illustrated by Hoffman, nor the fungus described by Persoon and by Fuckel.

A second collection in the Persoon herbarium at Leiden, No. 910.256-842.90 O.H., is, however, most significant. It is labelled: "*Peziza pallescens* P., Junghuhn leg. — Germania," and contains apothecia and the *Bispora* conidial fungus of the type illustrated by Hoffman and described by Fuckel. This specimen was apparently not seen by Dennis, as no annotation slip of his accompanies it. Though it may represent the actual material Persoon had in hand in 1799, there is no date associated with it either. We hereby designate this specimen as the neotype specimen of *Peziza pallescens* Pers. It agrees in all respects with the type specimen of *Bispora monilifera* Fuckel, on deposit at the Conservatoire et Jardin Botanique in Geneva, which we have also examined.

C. *Some preliminary thoughts on the ecology of Bisporella*

Whether or not *Peziza pallescens* and the conidial fungus *Bispora monilioides* are genetically connected must await cultural studies that have not, to our knowledge, ever been completed. Dematiaceous states of members of the Leotiaceae are exceptionally rare. We tend to wonder, along with Fuckel (1870), whether the apothecia might not represent a fungus parasitic on the Hyphomycete.

This feeling is strengthened by the observation that several related species, formerly placed in *Calycella,* often occur on other fungi. *C. sulfurina* is not uncommon on stromatic Pyrenomycetes, and *C. strumosa* (Ell. & Everh.) Dennis also occurs on old fungus stromata. Still another species, for which we have been unable to discover a species name, is common in North America on old fruitbodies of *Daedaleopsis confragosa* (Bolt. ex Fr.) Schroet. and occasionally on other polypore basidiocarps. In some of the same collections apothecia are also found on the nearby wood, raising the question as to whether they are growing there saprophytically or are growing on the mycelium of the Pyrenomycete or Basidiomycete within the wood. If so, it is possible that other species of *Bisporella* (= *Calycella* sensu Boudier) that are not associated with obvious ascocarps or basidiocarps may in fact be pathogenic on fungi invading the woody substrate rather than being saprophytes.

D. *The formal taxonomy of Bisporella, and a few transfers*

Since *Calycella* clearly cannot be retained for the common yellow species we so often encounter, and these cannot satisfactorily be referred to either *Helotium* or *Hymenoscyphus,* we propose to adopt *Bisporella* for them. Boudier and many others who have ignored *Bisporella* have, it should be noted, ranged its type species in *Calycella,* either as *C. pallescens* or as *C. monilifera.* We are aware that the genus may turn out to be rather large; we have found over 50 names that have been combined under *Calycella.* For the time being we are contenting ourselves with presenting the formal nomenclator for the genus and with transferring only four species to it. One of these transfers is a necessary new combination for the generic type species.

BISPORELLA Saccardo, Bot. Centralbl. 18: 218. 1884 (a name change).

≡ *Bispora* Fuckel, Jahrb. Nassauischen Vereins Naturk. 23-24: 310. 1870 (a later homonym; holotype species: *B. monilifera* Fuckel); non *Bispora* Corda 1837.

≡ *Helotium* Pers. ex St.-Amans subg. *Bisporella* (Sacc.) Lindau, Natürl. Pflanzenf. I 1(1): 207. 1896.

= *Calycella* Quél., Enchir. fung. 305. 1886 [a later homonym; lectotype species: *C. pallescens* (Pers. ex Gray) Quél., designated here]; non *Calycella* (Fr.) Boud. 1885, nec *Calycella* (Sacc.) Sacc. in Sacc. & Syd. 1899.

MISAPPLICATIONS: *Calycella* (Fr.) Boud. sensu Boudier non Fries.

HOLOTYPE: *Bispora monilifera* Fuckel [= *Bisporella pallescens* (Pers. ex Gray) Carp. & Korf].

1. **Bisporella pallescens** (Pers. ex Gray) Carp. & Korf, *comb. nov.*

≡ [*Peziza lenticularis* Hoffm., Deutschl. Flora oder Botan. Taschenb., Zweite Teil, pl. 13, f.4-5. 1795 (devalidated: pre-starting point; also later homonym); non *Peziza lenticularis* Bull. 1791 (devalidated: pre-starting point; sanctioned by Fries, Syst. mycol. 2(1): 133. 1822, Art. 13f).]

≡ [*Peziza pallescens* Pers., Obs. Mycol. 2: 85. 1799 (a name change; devalidated: pre-starting point).]

≡ *Calycina pallescens* (Pers.) ex Gray, Nat. Arr. Brit. Pl. 1: 670. 1821.

≡ *Peziza pallescens* (Pers. ex Gray) Pers., Mycol. Eur. 1: 294. 1822 (sanctioned by Fries, Syst. mycol. 2(1): 132. 1822, Art. 13f).

≡ *Helotium pallescens* (Pers. ex Gray) Fr., Summa veg. Scand., sect. post. 355. 1849.

≡ *Niptera pallescens* (Pers. ex Gray) Fuckel, Jahrb. Nassauischen Vereins Naturk. 25-26: 334. 1871.

≡ *Calycella pallescens* (Pers. ex Gray) Quél., Enchir. fung. 306. 1886.

≡ *Helotium citrinum* (Hedw. ex Purton) Fr. var. *pallescens* (Pers. ex Gray) Massee, Brit. fungus-fl. 4: 239. 1895.

= *Bispora monilifera* Fuckel, Jahrb. Nassauischen Vereins Naturk. 23-24: 310. 1870.

≡ *Peziza monilifera* (Fuckel) Cooke, Grevillea 4: 111. 1876.

≡ *Bisporella monilifera* (Fuckel) Sacc., Bot. Centralbl. 18: 218. 1884.

≡ *Hymenoscyphus moniliferus* (Fuckel) Phill., Man. Brit. Discom. 130. 1887 (ut *Hymenoscypha monilifera*).

≡ *Helotium moniliferum* (Fuckel) Rehm, Rabenh. Kryptogamenfl. Deutschl., Oesterr. Schweiz II 1(3)[39]: 790. 1893.

≡ *Calycella monilifera* (Fuckel) Dennis, Mycol. Pap. 62: 44. 1956.

2. **Bisporella citrina** (Batsch ex Fr.) Korf & Carp., *comb. nov.*

≡ [*Peziza citrina* Batsch, Elench. fung. contin. 2: 95, pl. 39, f. 218. 1789 (devalidated: pre-starting point); non *Peziza citrina* (Hedw.) With. 1796.]

≡ *Peziza citrina* Batsch ex Fr., Syst. mycol. 2(1): 131, 609. 1822; non *Peziza citrina* (Hedw.) With. ex Purton 1821 (devalidated: not sanctioned by Fries, Art. 13f), nec *Peziza citrina* Schw. 1822 (devalidated: not sanctioned by Fries, Art. 13f).

≡ *Calycella citrina* (Batsch ex Fr.) Boud., Bull. Soc. Mycol. France 1: 112. 1885; non *Calycella citrina* (Hedw. ex Purton) Quél. 1886 (later homonym).

= [*Octospora citrina* Hedw., Descr. adumb. microscopico-anal. muscorum frondosorum 2: 28, pl. 8B. 1789 (devalidated: pre-starting point).]

≡ [*Peziza citrina* (Hedw.) With., Arr. Brit. Pl., ed. 3, 4: 347. 1796 (devalidated: pre-starting point; also later homonym); non *Peziza citrina* Batsch 1789.]

≡ *Peziza citrina* (Hedw.) With. ex Purton, App. Midl. Fl. 3: 457. 1821 (devalidated: not sanctioned by Fries, Art. 13f); non *Peziza citrina* Schw. 1822 (devalidated: not sanctioned by Fries, Art. 13f; also later homonym), nec *Peziza citrina* Batsch ex Fr. 1822 (later homonym, but sanctioned by Fries, Art. 13f).

≡ *Calycina citrina* (Hedw. ex Purton) Gray, Nat. Arr. Brit. Pl. 1: 670. 1821.

≡ *Helotium citrinum* (Hedw. ex Purton) Fr., Summa veg. Scand., sect. post. 355. 1849.

≡ *Calycella citrina* (Hedw. ex Purton) Quél., Enchir. fung. 306. 1886 (later homonym); non *Calycella citrina* (Batsch ex Fr.) Boud. 1885.

= *Phialea citrina* (Fr.) Gill., Champ. Fr., Discom. 109. 1881 [basionym uncertain: either *Peziza (Phialea) citrina* Batsch ex Fr. 1822, or *Helotium citrinum* (Hedw. ex Purton) Fr. 1849].

3. Bisporella sulfurina (Quél.) Carp., *comb. nov.*

≡ *Helotium sulfurinum* Quél., Grevillea 8: 116. 1880.

≡ *Calycella sulfurina* (Quél.) Boud., Bull. Soc. Mycol. France 1: 112. 1885.

≡ *Calycina sulfurina* (Quél.) Kuntze, Rev. Gen. Pl. 3[2(2)]: 449. 1898.

4. Bisporella strumosa (Ell. & Everh.) Korf, *comb. nov.*

≡ *Helotium strumosum* Ell. & Everh., J. Mycol. 4: 56. 1888.

≡ *Pseudohelotium strumosum* (Ell. & Everh.) Sacc., Syll. fung. 8: 300. 1889.

≡ *Calycella strumosa* (Ell. & Everh.) Dennis, Persoonia 3: 68. 1964.

NOTES: Dennis (1964) described and illustrated the ascospores as non-septate. They are, in the portion of the type specimen we have examined (CUP-D 8494), distinctly one-septate at maturity (FIG. 1). The original description by Ellis and Everhart had the spores with "indications of a medial septum." This species occurs on old stromatic tissues identified by them as *Dichaena strumosa* Fr. on living *Quercus coccinea*. We have been unable to identify the host

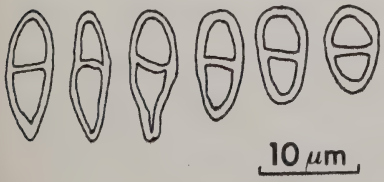

FIG. 1. Mature ascospores of *Bisporella strumosa*.

fungus with certainty. The ascospores of *B. strumosa* are, as Dennis (1964) noted, much broader than those of *B. sulfurina*, common on stromatic Ascomycetes in Europe.

ACKNOWLEDGEMENTS

We wish to thank the Directors and Curators of the herbaria at Berlin (B), Geneva (G), and Leiden (L) for their loans of type materials upon which these studies were based. We also thank Prof. G. L. Hennebert of the Université de Louvain for many stimulating discussions, during his recent stay at Cornell University as a Visiting Scientist, regarding some of the nomenclatural problems we encountered.

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MYCOTAXON

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BOOK REVIEWS

by

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B-P-H, BOTANICO-PERIODICUM-HUNTIANUM, édité par George M. H. LAWRENCE, A. F. Günther BUCHHEIM, Gilbert S. DANIELS et Helmut DOLEZAL. Hunt Botanical Library, Pittsburgh, Pa., 1063 p., 1968. Distribué par Stechert-Hafner, New York.

Ce compendium d'informations bibliographiques standardisées de plus de 12.000 périodiques de 45 langues et traitant des sciences botaniques est un outil indispensable à tout botaniste, chercheur, bibliothécaire dans ses référeneces à la littérature scientifique.

Les informations sont répertoriées alphabétiquement sous forme d'une abréviation non ambique de chaque périodique, suivie de l'intitulé entier, du lieu de publication, des volumes parus, des dates et des changements d'intitulé. Les abréviations différentes rencontrées dans la littérature scientifique sont aussi répertoriées avec renvoi à l'abréviation adoptée.

Dans la citation de références comme pour la recherche d'une abréviation ou d'un intitulé, cet ouvrage est un guide précieux.

THE FUNGI, AN ADVANCED TREATISE. Vol. IV A. A TAXONOMIC REVIEW WITH KEYS: ASCOMYCETES AND FUNGI IMPERFECTI, xviii + 621 p., 1973. Vol. IV B. A TAXONOMIC REVIEW WITH KEYS: BASIDIOMYCETES AND LOWER FUNGI, xxii + 504 p., 1973, édité par G.C. AINSWORTH, F.K. SPARROW et A.S. SUSSMAN, Academic Press, New York et London.

Ces deux volumes constituant le quatrième tome de THE FUNGI, un traité de grande réputation, fournissent un aperçu taxonomique, avec clés et illustrations de tous les champignons par les spécialistes de chaque groupe.

Le premier volume traite des Ascomycètes et Fungi imperfecti: les Endomycétales et autres levures (J.W. Kreger-van Rij), les Protomycétales et Taphrinales (C.L. Kramer), les Eurotiales (D.I. Fennell), les Pyrenomycètes: Erysiphales (C.E. Yarwood), Méliolales, Coronophorales et Sphaeriales (E. Müller et J.A. von Arx), les Loculoascomycètes (E.S. Luttrell), les Laboulbéniomycètes (R.K. Benjamin), les Discomycètes et Tubérales (R.P. Korf), les Hyphomycètes (W.B. Kendrick et J.W. Carmichael) et les Coelomycètes (B.C. Sutton).

Le second volume couvre les champignons inférieurs et les Basidiomycètes: les Acrasiomycètes (K.B. Raper), les Myxomycètes (C.J. Alexopoulos), les Mastigomycètes, Chytridiomycètes et Lagénidiales (F.K. Sparrow), les Plasmodiophoromycètes et les Péronosporales (Grace M. Waterhouse); les Saprolégniales et Leptomitales (M.W. Dick); les Mucorales (C.W. Hesseltine et J.J. Ellis), les Entomophthorales (G.M. Waterhouse), les Zoopagales (C.L. Duddington) et Trichomycètes (R.W. Lichtwardt); les Urédinales (G.F. Laundon) et Ustilaginales (R. Durán); les Phragmo- et Holobasidiomycetidae (R.F.R. McNabb et P.H.B. Talbot), les Aphyllophorales (P.H.B. Talbot, R.H. Petersen, K.A. Harrison et D.N. Pegler pour leur groupe respectif), les Agaricales (A.H. Smith) et les Gasteromycètes (D.M. Dring).

Il s'agit là d'un ouvrage clé qui sera très apprécié du spécialiste comme des débutant, car il contient une documentation abondante et de qualité et introduit à une connaissance plus large des champignons.

FUNGI. Vol. 3. POLYPORACEAE II (pileate), MUCRONOSPORACEAE II (pileate), GANODERMATACEAE, BONDARZEWIACEAE, BOLETOPSIDACEAE, FISTULINACEAE, par Stanislas DOMANSKI, Henryk ORTOS et Alina SKIRGIELLO. Edition revisée, Warszwa, Pologne, 332 p., 109 fig. 27 pl. Traduction anglais par A. Radziwitt, US National Center for Scientific, Technical and Economic Information, Washington.

La première édition de ce volume, parue en 1967 en polonais, sous le titre GRZYBY (Fungi), fait suit aux deux volumes, 1. BOLETALES, par A. Skirgiello (1960), et 2. POLYPORACEAE I, MUCRONOSPORACEAE I (Resupinate) par S. Domanski (1965).

147 espèces de Pologne appartenant à 47 genres sont décrites d'une manière méthodique et moderne et selon la nomenclature la plus récente. Les descriptions donnent une analyse détaillée des hyphes du carpophore et des organes de l'hyménium, et aussi l'habitat, la distribution et la comestibilité. 27 planches de bonnes photographies. Un bon livre pour l'identification plus moderne des champignons.

MICROFUNGI OF THE SOLOMON ISLANDS AND PAPUA-NEW GUINEA, par Takashi MATSUSHIMA, Shionogi Res. Lab., Shionogi Co., Kobe, Japan, 78 p., 169 fig., 48 pl., 1971.

L'auteur donne la description de 201 Fungi Imperfecti et 33 Ascomycètes, dont un grand nombre d'espèces nouvelles. D'un grand intérêt taxonomique, cet ouvrage excelle aussi par la qualité des dessins et des microphotographies.

ETUDE DES PHENOMENES DE REPRODUCTION LIES AU VIEILLISSEMENT ET AU RAJEUNISSEMENT DES CULTURES DE CHAMPIGNONS, par M. TAKASHIO. Thèse, Université de Liège, 152 p., 86 fig., 1973 (tiré de Ann. Soc. Belge Med. Trop. 53: 427-580, 1973).

Dans cette étude, l'auteur a établi par le croisement de souches de *Arthroderma simii* et *A. benhamiae* avec d'autres de *Trichophyton metagrophytes* et *T. interdigitale*, que le complexe *T. metagrophytes* appartient à *Arthroderma simii*, *A. benhamiae* et *A. vanbreuseghemii* n. sp.

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CHLOROSPLENIUM AND ITS SEGREGATES. I. INTRODUCTION AND THE GENUS CHLOROSPLENIUM [1]

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ABSTRACT

Many green Inoperculate Discomycetes have been artificially assigned to the genus *Chlorosplenium* and later shown to belong elsewhere. Three genera are recognized for the remaining species in this monograph: *Chlorosplenium* sensu stricto, with two accepted species, *Chlorociboria* with four accepted species (one divided into two subspecies), and a new genus, *Chlorencoelia*, with two accepted species. A key to these genera and 14 additional genera of the Helotiales with one or more aeruginous species is provided.

In the monographic treatment of *Chlorosplenium*, one new combination in that genus is proposed: C. hypochlora. Forty-three epithets previously treated in *Chlorosplenium* are either excluded or placed in synonymy on the basis of type studies. New combinations proposed for some of these are Claussenomyces salviicolor, Cyathicula fuegiana, C. strobilina, Dasyscyphus aeruginellus, and D. melatheja. Six epithets

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[1] Based on a thesis presented to the Graduate School of Cornell University in partial completion of the requirements for the degree of Doctor of Philosophy.

[2] Present address: GIBCO Diagnostics, 4505 Kelly St., Bakalar Air Base, Columbus, Indiana 47201.

remain doubtful and insufficiently known.

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INTRODUCTION

Many species of Inoperculate Discomycetes are viridescent or aeruginous in coloration and most of these have at one time in their taxonomic histories been placed in the genus *Chlorosplenium* Fr. It has long been recognized by taxonomists that this assemblage of species, considered congeneric merely on the basis of their common coloration, was probably heterogeneous. Subsequently, some have been removed to other accepted genera. Seaver (1936) separated three common species which he felt were definitely not congeneric with the type of the genus, *Chlorosplenium chlora* (Schw.) Curtis in Sprague, into a new genus, *Chlorociboria* Seaver. There is no complete monographic study of either genus, though *Chlorociboria* has been accepted as a segregate by Kobayasi (1937, 1939), White (1941), Kanouse (1947), Buchwald (1949), Dennis (1956, 1958a, 1958b, 1960), Korf (1958, 1973), and Ramamurthi, Korf, and Batra (1958).

This work treats *Chlorosplenium* and *Chlorociboria* monographically and erects and points out the need for a new genus, *Chlorencoelia*. In addition, a key is provided to other inoperculate genera which contain one or more aeruginous species: *Bisporella* Sacc. [=*Calycella* (Fr.) Boud. sensu Boud.], *Catinella* Boud., *Chloroscypha* Seaver, *Ciboria* Fckl., *Claussenomyces* Kirschst., *Cordierites* Mont., *Cyathicula* de Not., *Dasyscyphus* (Nees) ex S. F. Gray, *Haglundia* Nannf., *Holwaya* Sacc., *Phaeohelotium* Kanouse, *Poculum* Vel., *Rutstroemia* Karst., and *Velutarina* Korf.

MATERIALS AND METHODS

Though a number of species occurring in the northeastern, southeastern, and mid-western United States and the Caribbean have been repeatedly collected by the writer and studied in the fresh condition, many of the species are known to him only from herbarium specimens. Notes on cultural characters of those species successfully cultured on artificial media are recorded in the descriptions, though in no case have apothecia been produced in culture. The relationships of the various genera and species have been approached from an investigation of the apothecial tissues and of other microscopic and gross characters.

Attempts to locate nuclei by embedding in paraffin, by phase microscopy, and by flourescence microscopy failed.

Dried material was examined as follows: a portion of apothecium was wetted in an approximately 3% aqueous solution of Aerosol OT (Fischer Scientific Co. No. SO-A-292), soaked in water for 5 to 10 min, placed on the stage of a freezing microtome and oriented in a drop of 50% aqueous solution v/v of commercial mucilage (LePage's), frozen and sectioned at 15 to 25 µm. Sections were then removed tc a drop of water on a microscope slide and allowed to dry. The sections were rehydrated, stained with either Metzer's Reagent (Ainsworth, 1971) and/or Poirrier's Blue in lactophenol, then mounted in lactophenol and ringed with glyptal (General Electric No. 1201 Red Enamel) as outlined by Travis (1968).

Spore measurements were made only on spores floating free in the mounting media. Ascus measurements were taken only on those asci which contained fully-formed spores. Drawings were made using a camera lucida. Photographs were taken with a Zeiss WL microscope.

TERMINOLOGY

The terminology used in the descriptions of zones of the apothecium and the apothecial types is that outlined by Korf (1952, 1958, 1973). The term "disc" is used to refer to the hymenium in gross view, and the term "hymenium" is restricted to the asci and paraphyses when viewed in section. The term "receptacle" is used to denote the flanks of the apothecium.

The term "gelatinized hyphae" is used here to describe hyphae with thick and refringent walls. The term "gel tissue" refers to the zones of the excipulum in which hyphae are embedded in mucilaginous material.

When the apical cylinder surrounding the ascus plug becomes blue in Melzer's Reagent, the standard Discomycete convention J+ is used; when such a blue reaction is absent, J– is used.

The term "tomentum hyphae" is used here to refer to any filamentous hyphal outgrowths of the ectal excipulum which are continuous with this tissue and are more or less relatively undifferentiated hair-like hyphal outgrowths. If these were more highly differentiated, they could be called hairs, and in some species they have been so termed in the literature.

Colors cited in the descriptions are those in conventional English usage when non-capitalized and when capitalized are those of Ridgway (1912).

The sign (!!) when used after a name in lists of synonyms indicates that type or isotype material has been examined; the sign (!), that syntype, paratype, or other authentic material has been examined.

The illustrations cited are those which definitely represent the species in question; doubtful or schematic ones have been omitted. Citations of particularly complete and accurate illustrations are indicated with an exclamation point.

The use of "per" and of ": Fr." is used here as outlined by Donk (1957, 1961).

Abbreviations used in the citation of references are those as set forth in G. H. M. Lawrence, *et al.* (1968), "Botanico-Periodicum-Huntianum." A few abbreviations to older mycological books were taken from Seaver (1942), "The North American Cup-fungi (Operculates)."

The herbarium abbreviations are those of Lanjouw and Stafleu (1964). The personal herbarium of Dr. Richard P. Korf is abbreviated R.P.K. In the citation of specimens examined, only accession numbers and herbaria have been listed, with the exception of type specimens and specimens considered critical by the author. Microscopic preparations of specimens which have been examined are deposited in the Plant Pathology Herbarium at Cornell University (CUP) and have been given Cornell accession numbers. These numbers are also indicated on the annotation slips with the specimens that have been returned to the original herbaria.

KEY TO THE GENERA OF HELOTIALES CONTAINING AERUGINOUS SPECIES

The following key will serve not only to identify the genera treated in this monograph, *Chlorosplenium*, *Chlorociboria*, and *Chlorencoelia*, but should aid in separating those genera which might easily be confused with tnem. The key is based in part on the generic concepts outlined by Korf (1973) and the author is indebted to Dr. Korf for his permission to reproduce parts here.

1. Apothecia arising from a stroma or sclerotium, or from stromatized patches of host tissue, usually brownish and stalked; ascus pore almost always blue in iodine. .... SCLEROTINIACEAE 2

1'. Apothecia not arising from a stroma or sclerotium, nor from stromatized patches of host tissue............. 4

2 (1). In section, apothecium with a strongly gelatinized layer in the ectal excipulum; outermost layer of the excipulum not composed of globose cells........................... *Poculum* Vel. [If specimen keys here, cfr. *Chlorosplenium elatinum*, excluded species #15 under *Chlorosplenium*.]

2'(1). In section, apothecium with globose cells as the outermost layer of the ectal excipulum (rarely covered with a scurfy layer of hyphae running parallel to the surface), rarely a thin layer of gelatinized hyphae present as an inner layer of the ectal excipulum.......... 3

3 (2'). Apothecia greenish, on cone scales of *Picea*, ascospores less than 10 µm long..... *Rutstroemia* Karst. [*R. bulgarioides* is now the only species in the genus, which provides a very different concept of the genus from that adopted by White (1941) and most recent authors. This species has also been placed in *Chlorosplenium* and *Chlorociboria*, and is the type of *Piceomphale*, a recent synonym. If specimen keys here, see excluded species #9 under *Chlorosplenium*.]

3'(2'). Apothecia not greenish, on cone scales of *Abies* spp., *Picea glauca*, and *Pseudotsuga taxifolia*, or greenish and on catkins of *Alnus*, ascospores usually more than 10 µm long.................. *Ciboria* Fckl. [If the specimen keys here, cfr. *Ciboria rufo-fusca*, excluded species #9a and *C. viridi-fusca (=Chlorosplenium amenticolum)*, excluded species #5 under *Chlorosplenium*.]

4 (1'). Apothecia sessile to subsessile. ectal excipulum of thin-walled to thick-walled textura angularis to textura globulosa, walls of these cells normally dark..... DERMATEACEAE 5

4'(1'). Apothecia stipitate to substipitate (or if sessile then ectal excipulum *not* composed of thin-walled to thick-walled textura angularis to textura globulosa, and walls of ectal excipular cells hyaline or brown.................. 7

5 (4). Ascospores one-celled, hyaline becoming brown, constricted in the middle, distinctly 1-seriate; apothecium strongly ionomidotic.... *Catinella* Boud. [*C. olivacea* (Batsch per Pers.) Boud. (= *C. nigro-olivacea* [Schw.] Durand) has a worldwide distribution, on wood, and may be the only species. While this species has never been placed in *Chlorosplenium* or *Chlorociboria*, due to its green coloration it is often mistakenly so identified.]

5'(4). Ascospores unicellular, rarely 1-septate, hyaline, never brown, never constricted in the middle, spores irregularly biseriate..................... 6

6 (5'). Apothecia distinctly hairy, ascus pore not blue in iodine...................... *Haglundia* Nannf. [*H. perelegans* Nannf. is the type species. Due to its hymenial color and macroscopic characters it is easily mistaken for a species of the genus *Chlorosplenium*.]

6'(5'). Apothecia glabrous, ascus pore blue in iodone.. .... *Chlorosplenium* Fr. emend. Dixon

7 (4'). Apothecia almost always provided with distinct and evident hairs at the margin or covering the excipulum; paraphyses filiform to lanceolate; ectal excipulum composed of brick-shaped cells (textura prismatica), rarely of globose cells or elongated hyphae; no gelatinized hyphae formed...................... .... HYALOSCYPHACEAE .... *Dasyscyphus* (Nees) ex Gray [If specimen keys here, cfr. *D. aeruginellus*, excluded species #2, *D. melatheja*, excluded species #21, and *D. sericeus* (and its probable synonym, *Dasyscyphella aeruginosa*), excluded species #34, all

under *Chlorosplenium*. The author has also seen an apparently undescribed species collected in Mexico (CUP-ME 127) that stains the petioles and mid-veins of a *Quercus* sp. green, and is clearly a *Dasyscyphus* species with lanceolate paraphyses.]

7'(4'). Apothecia not provided with distinct and evident hairs (except in *Chlorociboria*); paraphyses filiform; ectal excipulum composed of elongate hyphae or angular to globose cells; gelatinized hyphae often formed....... LEOTIACEAE 8

8 (7'). Apothecia some shade of yellow to orange or orange-brown, never green.................... 9

8'(7'). Apothecia some shade of green, never yellow to orange (disc may be yellow, but never the entire apothecium).................................. 11

9 (8). Hyphae or cells of the outermost layer with thickened, glassy walls (at fullest development the walls become a refractive gel in which the hyphal lumina are embedded)............................ 10

9'(8). Outermost layer of the excipulum not composed of undulating glassy-walled hyphae, but instead composed of hyaline, thin-walled textura prismatica to textura angularis; ascospores becoming brown and 1- to 3-septate at maturity.................. .... *Phaeohelotium* Kanouse

[This genus is included in the key since *P. monticola* (Berk.) Dennis (= *P. flavum* Kanouse) may easily be mistaken in the field for a member of the genus *Chlorosplenium*.]

10 (9). Apothecia turbinate to substipitate, rarely stipitate, some shade of yellow to orange; outermost layer of the excipulum of undulating, glassy hyphae, the individual hyphae often difficult to follow; ascospores frequently 1-septate.................... *Bisporella* Sacc.

[= *Calycella* (Boud.) Boud. sensu auct.]

[This genus is included in the key since *B. citrina* (Batsch per Fr.) Korf & Carp., a worldwide and very common species, is easily confused in the field with *Chlorosplenium chlora* or with *Phaeohelotium monticola*; see Korf and Carpenter (1974).]

10'(9). Apothecia stipitate, of various colors but rarely yellow; outermost layer of the excipulum of glassy, parallel, agglutinated hyphae forming a tough "skin" in squash mounts, the tissue strongly differentiated from the thin-walled hyphae of the medullary excipulum; ascospores usually unicellular, rarely 1- to 3-septate; in some species the excipulum is prolonged at the margin to form long or short teeth.......... .... *Cyathicula* de Not. [If specimen keys here, cfr. *Cyathicula fuegiana* and *C. strobilina* (excluded species #19 and #9b under *Chlorosplenium*).]

11 (8'). Apothecia intensely green (viridescent to aeruginous) to olivaceous-green when fresh, drying to dark greenish-black, never brown or olivaceous-brown.. 12

11'(8'). Apothecia brown to olivaceous-brown when fresh (or if olivaceous green, then with the hyphae of the medullary tissues strongly granulated), drying dark brown to black.. 14

12 (11). Apothecia intensely green to olivaceous-green or nearly black; hyphae of the medullary and ectal excipulum embedded in a gel......... .... *Claussenomyces* Kirschst. [This genus is usually called *Corynella*, an invalid name. The genus is in need of monographic work and due to the green coloration of several species and the ability of some species to stain wood green in very localized patches, specimens are often mistaken for members of the genus *Chlorociboria*. If specimen keys here, cfr. *Claussenomyces atrovirens* and *C. salviicolcr*, excluded species #6 and #32 under *Chlorosplenium*.]

12'(11). Apothecia yellow-green to blackish green or aeruginous, hyphae of the medullary and ectal excipulum gelatinized but *not* embedded in a gel.. 13

13 (12'). Apothecia on foliage of conifers; never imparting a green stain to the substrate............... .... *Chloroscypha* Seaver [If specimen keys here, cfr. *C. chromomela*, excluded species #12 under *Chlorosplenium*.]

13'(12'). Apothecia on decayed wood, never on foliage of conifers, always imparting a green stain to the substrate........ *Chlorociboria* Seaver emend. Dixon

14 (11'). Apothecia containing large (ca. 30 µm broad) vesicular cells filled with greenish-brown sap, ascospores eventually pale brown............. .... *Velutarina* Korf [If specimen keys here, cfr. *V. rufo-olivacea*

(Alb. & Schw. per Fr.) Korf (*Lachnella aeruginosa* Sacc. & Speg. is a synonym based upon my study of the type specimen.)]

14'(11'). Apothecia not containing vesicular cells filled with greenish-brown sap, ascospores always hyaline.................................. 15

15 (14'). Ascospores filiform-clavate; paraphyses forming an obvious epithecium................ *Holwaya* Sacc. [Due to the green coloration and general morphology of some species of this genus, specimens are often mistaken for members of *Chlorencoelia*. If specimen keys here, cfr. *H. mucida* (Schulzer) Korf & Abawi (1971).]

15'(14'). Ascospores irregularly ellipsoid to allantoid, epithecium not present........................... 16

16 (15'). Apothecia giving an ionomidotic reaction in KOH, ascus pore not blue in iodine........... .... *Cordierites* Mont. [Some species of this genus are easily mistaken for species of *Chlorencoelia* due to the coloration of their apothecia and an ectal excipulum composed of angular cells usually retaining some hyphal orientation perpendicular to the outer surface. If specimen keys here, cfr. *Chlorosplenium atroviride*, excluded species #7 under *Chlorosplenium*.]

16'(15'). Apothecia not giving an ionomidotic reaction in KOH, ascus pore always blue in iodine...... .... *Chlorencoelia* Dixon

HISTORY AND NOMENCLATURAL STATUS OF THE GENERIC NAMES CHLOROSPLENIUM FRIES AND CHLOROCIBORIA SEAVER

The genus *Chlorosplenium* was erected by Fries (1849) with the generic diagnosis: "Discus ex ascis dehiscentibus sporas effudentibus viridi-pulverulentus; reliqua prior." The circumscription of the genus included three species: *Peziza chlora* Schw. (gratuitously renamed by Fries as *Chlorosplenium schweinitzii*), *P. chlorascens* Schw. (renamed by Fries as *C. repandum*), and *P. torta* Schw. (renamed by Fries as *C. subtortum*).

The genus was considered by later authors, i.e., de Notaris (1864), Nylander (1869), Ellis and Everhart (1893, 1895), Cooke (1892), etc. to be characterized predominantly by the green coloration of the apothecia. On this basis de Notaris (1864) added to the genus *Peziza versiformis* Pers. and *P. aeruginosa* Pers., clearly stating: "Non ho esemplari di *Peziza chlora, chlorascens,* e *subtorta* Schweinz., dalle quali ebbe origine questo genere." It should be noted that both of these species were known to Fries, and he considered them (Fries, 1849) to be members of the genus *Helotium* and not congeneric with his genus *Chlorosplenium.* Clements and Shear (1931) designated *C. aeruginosum* (Oeder) Fr. as the type of the genus, but as Seaver (1936) pointed out, "so far as we know, Fries never treated this species as a *Chlorosplenium.*" Seaver also held that the species added by de Notaris in 1864 were in fact not congeneric with the type species of *Chlorosplenium, P. chlora,* and should be transferred to another genus. Seaver erected the genus *Chlorociboria,* feeling as Nannfeldt (1932) did that these species were more closely related to the genus *Ciboria.*

When Seaver (1936) erected the genus *Chlorociboria,* however, he failed to provide a Latin diagnosis, required for valid publication of new names after 1 Jan. 1935. Hence, while the genus was accepted by Kobayasi (1937, 1939), White (1941), Kanouse (1947), Buchwald (1949) and Dennis (1956), the genus itself and the combinations made in it by Kanouse and Dennis were not validly published according to the International Code of Botanical Nomenclature (Stafleu, 1972: Arts. 36, 43). This was pointed out by Ramamurthi, Korf and Batra (1958), and since they felt that the genus had taxonomic integrity, they supplied the Latin diagnosis and re-made the combinations in the names of the various authors who had first proposed them. In their circumscription, emended from that of Seaver (1936, 1951), they included *Peziza bulgarioides* Rabenh. [as had Seaver (1951), who had called it *Chlorociboria strobilina* (Alb. & Schw.) Seaver]. Svrček (October, 1957), some six months prior to the actual date of issue (March 28, 1958) for the Ramamurthi, Korf and Batra paper in Mycologia, published a new monotypic genus, *Piceomphale,* based upon *Peziza bulgarioides.* According to the present International Code of Botanical Nomenclature (Stafleu, 1972: Art. 63) the name *Chlorociboria* Seaver ex Ramam., *et al.* becomes *superfluous,* and the name is thus "illegitimate and must be rejected." Technically the name cannot be taken up again even if one excludes *P. bulgarioides* and considers only those species which are in an unquestionable congeneric relationship with the type, *Helvella aeruginosa* Oed. [designated by both Seaver (1936) and Ramamurthi, Korf and Batra (1958)]. Later, Korf (1959a, 1959b) abandoned the name *Chlorociboria,* having concluded that the differences in tissue structure between the type species of *Chlorosplenium, C. chlora,* and the other species he and his students (Ramamurthi, Korf and Batra, 1958) had treated in *Chlorociboria* were not as taxonomically significant as they had first believed. He was followed in this decision by Dennis (1960, 1961, 1963, 1968, 1970, 1972).

Korf (1970) wrote: "The whole problem of superfluous names, and in particular of Article 63, has been submitted to committees of the International Botanical Congresses, who reported in 1964 at Edinburgh and in 1969 at Seattle. The problems remain unresolved, with final decisions now delayed until the next (Leningrad) Congress. Though the committee members appear to disagree on nearly all substantive issues, they show remarkable unanimity in agreeing the Article as written is wrong, and must be changed."

During the course of this study, Dr. Korf has again examined the problem of the status of *Chlorociboria* Seaver and is in agreement with my taxonomic conclusions that the genus *Chlorociboria* as I have emended it does have integrity. We feel that since the type of the genus *Chlorociboria* was clearly indicated by both Seaver (1936) and Ramamurthi, Korf and Batra (1958), that the name should be adopted for this circumscription. We also believe that Article 63 is destined to be changed, at least as it applies to fungal nomenclature, judging by the discussions in the nomenclature sessions at the First International Mycological Congress in Exeter, 1971. To be forced into the position of now burdening the literature with an added generic name when one is available but unusable due to its being superfluous *as now defined* seems an untenable position. Such a new name would itself become superfluous when the definition is changed. Hence, I propose to use the name *Chlorosplenium* Fr. for *C. chlora* and its allies and to use *Chlorociboria* Seaver ex Ramam., Korf & Batra for the aeruginous colored and wood-staining *C. aeruginosa* and its allies.

TAXONOMIC CONSIDERATIONS

Attempts to define and delimit generic, specific, and infraspecific categories in the Inoperculate Discomycetes had been predominantly on the basis of similarities in gross morphology and characters of asci, ascospores, and paraphyses until Starbäck (1895) pointed out the importance of microanatomical characters of the apothecium in delimiting categories in this group. The use of these characters was re-emphasized by Nannfeldt (1932) in his "Studien über die

Morphologie und Systematik der nicht-lichenisierten inoperculaten Discomyceten."

In this study careful consideration has been given to the microanatomical features exhibited by the various collections in reaching descision on generic, specific, and infraspecific circumscriptions. In delimiting species in the genus *Chlorociboria,* Ramamurthi, Korf and Batra (1958) pointed out the importance of using the characters exhibited by the tomentum hyphae, and these characters have been utilized in this study in defining species within this genus.

I have attempted to delimit genera and species on the basis of my experience with character variation in those Inoperculate Discomycetes known to me. It is hoped that this use of microanatomical features of the apothecium has made possible the disposition of species and genera on a more natural basis. In most species treated in this monograph, it has not been necessary to recognize infraspecific categories. *Chlorosplenium brasiliense* is, however, in all respects similar to *Chlorociboria aeruginascens* subsp. *aeruginascens* except that it has smaller asci and ascospores; because it is geographically discontinuous, it is treated here at the subspecific rank.

Phylogenetic implications are essentially impossible to draw in this group of fungi. Attempts at such phylogenetic ranking have not been made, and genera and species are presented in the order in which they appear in the keys. The three accepted genera are assigned positions within tribes of the family Dermateaceae and the family Leotiaceae (= Helotiaceae).

THE GENUS CHLOROSPLENIUM FR. emend. DIXON

The genus *Chlorosplenium* when erected by Fries (1849) was treated as a member of his "Series II" *Lachnea* and "Tribus" *Fibrina.* He was followed in this decision by Berkeley and Curtis (1869) and Berkeley (1875). With the addition of *C. aeruginosum* and *C. versiforme* by de Notaris (1864) the genus has almost exclusively been treated as a member of the Leotiaceae (= Helotiaceae) by later workers.

Cooke and Peck (1872) were evidently the first to note the similarities of *Peziza chlora* to *Mollisia,* when they referred to a Berkeley species as *"Peziza (Mollisia) crocitincta;"* that species is a synonym of *P. chlora.* Nannfeldt (1932) also questioned whether *C. chlora* should be considered congeneric with such species as *P. aeruginosa, P. aeruginascens,* and *P. versiformis,* which he felt were closer to

Ciboria; he pointed out a few differences in tissue structure, especially the fact that, "Der basale Teil der Apothecien baut sich nach aussen aus einem dichten Gewebe ungefähr isodiametrischer Zellen mit dunkel graubraunen Wänden auf,..." However, Nannfeldt did not give an opinion as to the taxonomic position of *Chlorosplenium* as typified by *C. chlora*.

My studies have shown that the members of this genus *(sensu meo)* are sessile, cupulate, fleshy, have an ectal excipulum composed of dark-walled textura globulosa in mature specimens, and produce from the ectal excipulum dark-walled, septate, basal hyphae similar to those found in the Mollisioideae. Hence, I conclude on the basis of these characters and an examination of species now treated in the Dermateaceae that this genus should be considered as a member of the family Dermateaceae, subfamily Mollisioideae, and tribe Mollisieae.

GENERIC DIAGNOSIS
OF THE GENUS CHLOROSPLENIUM FR. emend.
(HELOTIALES, DERMATEACEAE)

CHLOROSPLENIUM Fr., Summa Veg. Scand. p. 356. 1849, emend. Dixon

≡ *Chrysosplenium* Fr. in Allescher, Ber. Bot. Vereines Landshut 15: 82. 1898. (Lapsus calami)

NAME: from Greek, "Chloris," the green one, and the Latin, "splenium," spleenwort; referring to the green coloration and the shape of the apothecium.

LECTOTYPE: Peziza chlora Schw., selected by Nannfeldt (1932 ut Pseudotypus) and by Seaver (1951).

Apothecia: < 3 mm in diam., sessile to sub-sessile.

Disc: cupulate to convex-expanded, varying widely in coloration from light yellow to yellowish green or grey-green.

Receptacle: glabrous, concolorous with disc to olive-brown to brownish-grey-black in fully mature specimens.

Asci: 8-spored, cylindric-clavate, J+, arising from repeating croziers.

Ascospores: fusitorm to fusiform-elliptic, hyaline.

Paraphyses: hyaline, branching near the base, septate.

Medullary Excipulum: composed of hyaline to light brown, thin-walled, loose textura intricata.

Ectal excipulum: hyaline to dark brown-walled textura angularis to textura globulosa, giving rise at points to hyaline to dark brown-walled hyphae running parallel to the outer surface of the apothecium.
Habitat: on decorticated wood.

KEY TO THE SPECIES OF CHLOROSPLENIUM

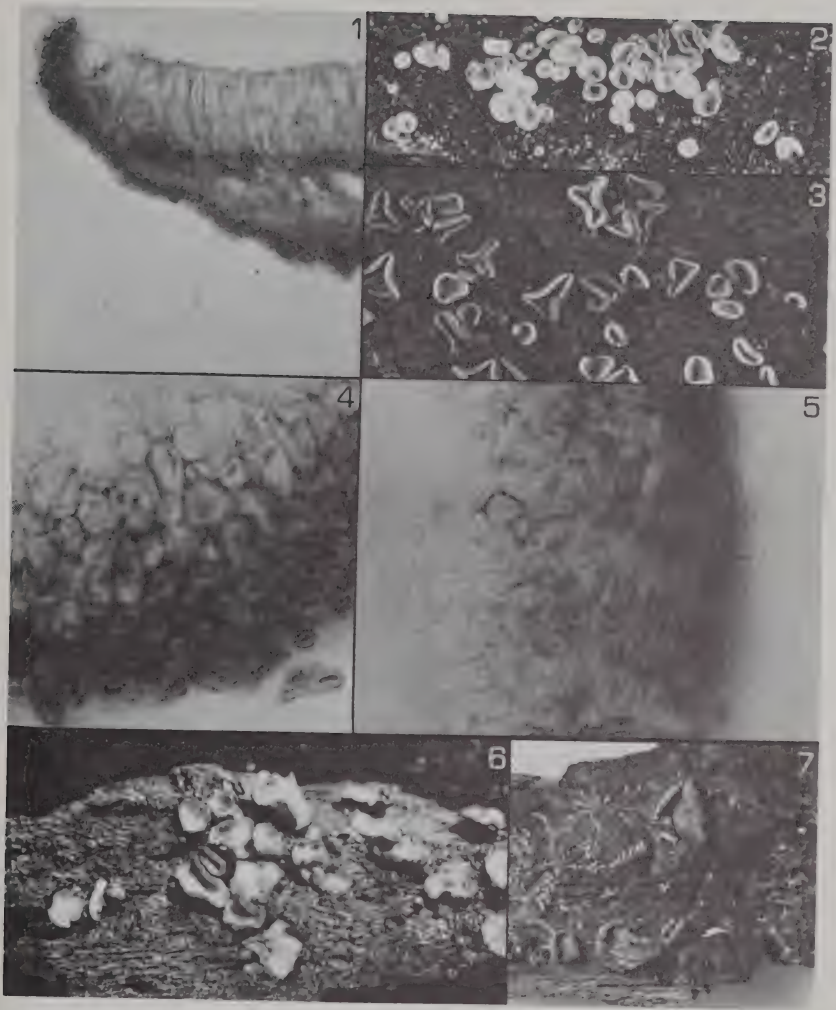
1. Ascospores (5-) 6-7 (-9) × 1.2-2 (-3) µm; asci (40-) 45-55 (-60) × (4-) 5-6 (-7) µm; hymenium and medullary tissues *not* separating easily from receptacle tissue in old and dried specimens................ 1. *C. chlora*

1'. Ascospores (8-) 9-14 (-15) × 2-4 µm; asci 70-95 × (5-) 6-8 (-9) µm; hymenium and medullary tissues easily separating from receptacle tissue in old and dried specimens............................. 2. *C. hypochlora*

1. CHLOROSPLENIUM CHLORA (Schw. : Fr.) Curtis in Sprague, Proc. Boston Soc. Nat. Hist. 5: 330. 1856.
≡ *Peziza chlora* Schw., Schr. Naturf. Ges. Leipzig 1: 122. 1822 (!!), : Fries, Syst. Mycol. 2(1): 115. 1822.
≡ *Chlorosplenium schweinitzii* Fr., Summa Veg. Scand. p. 356 (in nota). 1849.
≡ *Helotium chlora* (Schw. : Fr.) Morgan, J. Mycol. 8: 184. 1902.
= *Peziza chlorascens* Schw., Trans. Amer. Philos. Soc. 4: 175. 1832 (!!).
≡ *Chlorosplenium repandum* Fr., Summa Veg. Scand. p. 356 (in nota). 1849.
≡ *Lachnella chlorascens* (Schw.) Morgan, J. Mycol. 8: 187. 1902.
= *Peziza crocitincta* Berk. & Curt., Grevillea 1: 6. 1872 (!!).
≡ *Pezizella crocitincta* (Berk. & Curt.) Sacc., Syll. Fung. 8: 286. 1889.
= *Chlorosplenium olivaceum* Seaver, N. Amer. Cup-Fungi (Inopercul.) p. 105. 1951 (!!) (non *C. olivaceum* Rick, Brotéria, Sér. Bot. 25: 98. 1931).

(Figs. 1-5, 8)

Apothecia: superficial, solitary to gregarious to caespitose, sessile to sub-sessile, circular to laterally compressed, at first globose and closed, expanding and be-



FIGS. 1-7. Photographs of *Chlorosplenium* spp. FIGS. 1-5. *C. chlora*. 1. Portion of a section of an apothecium, CUP 51658, × 575. 2. Freshly collected apothecia, CUP 51667, approx. × 1.5. 3. Apothecia after drying, CUP 51667, approx. × 3. 4. Section of part of ectal excipulum, CUP 51658, × 2100. 5. Section of part of ectal excipulum and external hyphae parallel to the flank of the apothecium, CUP 51658, × 2100. FIGS. 6-7. *C. hypochlora*, CUP 52724. 6. Rehydrated apothecia, approx. × 4. 7. Dried apothecia, approx. × 4.

coming cupulate to almost discoid, margins more or less persistently incurved, when dry margins enrolling to the point of often touching.

Disc: < 2 × 3 mm in diam., cupulate to convex-expanded, color varying widely from yellow through shades of olive-green, color often bleaching so disc appears whitish or cream-yellow, becoming black with age.

Receptacle: glabrous, yellow to olivaceous green to dark brown toward the base, often becoming ochraceous upon drying, especially on the flanks of the apothecium, lower portion often vertically ribbed or furrowed, especially upon drying.

Hymenium: 35-65 µm high, hyaline.

Asci: cylindric-clavate, tapering to a short stalk, (40-) 45-55 (-60) × (4-) 5-6 (-7) µm (mean of collections 50 × 5 µm), J+, 8-spored, apex rounded to sub-conic, wall at apex 0.5-1.0 µm thick, wall 0.25-0.5 µm thick along the sides of the ascus, maturing successively, arising from repeating croziers.

Ascospores: irregularly biseriate, fusiform-elliptic, hyaline, unicellular, biguttulate, smooth-walled, (5-) 6-7 (-9) × 1.5-2 (-3) µm (mean of collections 6.5 × 2.0 µm).

Paraphyses: filiform, hyaline, septate, blunt at the apex, branching near the base, 1.5-2 µm in diam., scarcely extending beyond asci.

Subhymenium: (5-) 10-20 (-40) µm thick, of hyaline to dark, thin-walled, tightly compacted textura intricata, hyphae 1-3 µm in diam.

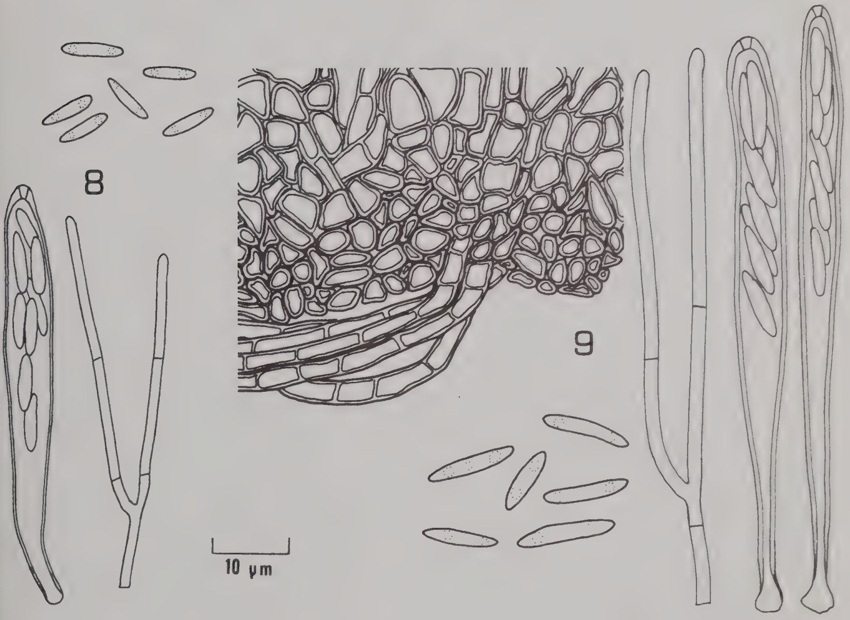
Medullary Excipulum: of hyaline to light brown, thin-walled, loose textura intricata, hyphae 3-4 µm in diam.

Ectal Excipulum: 25-105 µm thick, of one or two layers, innermost layer 20-40 µm thick, of thin-walled textura angularis, cells large, 3-10 × 5-18 µm, with light brown walls, often interspersed with small pockets of textura intricata with light brown walls; outer layer 10-40 µm thick, of dark, thick-walled textura angularis to textura globulosa, cells 3-10 × 3-7 µm, walls 0.25-1 µm thick, giving rise to hyaline to dark-walled hyphae running parallel to the outer surface of the apothecium (often numerous at the base of the apothecium) and here and there forming what appears to be an outer layer < 30 µm thick.

Cultural Characters: Very slow growing on potato dextrose agar (PDA), producing a greyish-black humped-up colony with tints of yellow. No conidia produced. Agar appearing black when viewed from underside. Hyphae 2-3 µm in diam., septate, branched, thick-walled, with hyaline to dark brown to brownish-black walls and contents. Colony very hard to the touch, and often producing "stroma-like growths" which have a cortex of dark-walled textura globulosa and a medulla of hyaline to light brown-walled, loose textura intricata. Colonies also produce "synnema-like projections" which when squashed are seen to be formed of thick, dark-walled hyphae oriented parallel to each other. Culture on deposit with American Type Culture Collection as ATCC 24030 (= culture from Mary Elliott, Canada Dept. of Agriculture, Ottawa, Canada).

Habitat: on decorticated and decayed wood, collected on *Castanea, Quercus, Castanopsis, Abies, Tsuga,* and unidentified wood.

Range and Seasons of Fructification: North America, Australia, Indonesia, Japan, Jamaica, Union of Soviet Soci-



FIGS. 8-9. Camera lucida drawings of *Chlorosplenium* spp., × 1000. FIG. 8. *Chlorosplenium chlora*. Ascus, paraphysis, and six ascospores, CUP 51656. FIG. 9. *C. hypochlora*. Portion of ectal excipulum and hyphae parallel to the flank of the apothecium, paraphysis, two asci, and six ascospores, CUP 52724.

alist Republics; Spring, Summer, Autumn, and Winter (most collections from Spring to Autumn).

Name: from Greek, "Chloris," the green one; referring to the yellowish green nature of the apothecium.

Type Locality: Bethlehem, Pennsylvania.

Presumed Type Specimen: (substrate unknown), (locality unknown, ? Bethlehem, Pennsylvania), Schweinitz, (date unknown), PH-Schweinitz Syn. N. A. No. 872 (=CUP 51664); Isotype, CUP-D 3882 (77-17).

Illustrations: Cooke and Peck, Grevillea 1: pl. 1, fig. 5. 1872 [ut *Peziza (Mollisia) crocitincta*]; Dennis, Kew Bull. 13: 341. 1958; Korf, Bull. Natl. Sci. Mus. 4: 394. 1959.

Exsiccati: Ellis & Everhart, Fungi Columbiani No. 249 (ut *Chlorosplenium schweinitzii)*, CUP-D 10291 (77-40), FH; Ellis & Everhart, North American Fungi No. 664 (ut *Peziza*), CUP-D 9244 (77-36); Ravenel, Fungi Caroliniani No. 39 (ut *Peziza*), CUP-D 6333 (77-27), FH; Reliquiae Farlowianae No. 107, CUP; Wilson & Seaver, Ascomycetes and Lower Fungi No. 1, CUP-D 10006 (77-37).

Specimens Examined: U.S.A. - ALABAMA: CUP-D 4087 (77-20), 5020 (77-21). DELAWARE: CUP-D 8046 (77-3). GEORGIA: ISOTYPE of *Peziza crocitincta,* on rotten oak logs, Catoosa Springs, Ravenel No. 1730, (no date), K, CUP-D 3761 (77-16); ISOTYPE of *Chlorosplenium olivaceum,* on decayed wood of *Quercus* sp., Princeton, J. H. Miller, Feb. 21, 1931, NY (= CUP 51722). INDIANA: CUP 51660, 51661, CUP-D 10593 (77-41), 10956 (77-48). KENTUCKY: R.P.K. 3276. MAINE: FH-Thaxter 3684. MARYLAND: CUP 51583. MASSACHUSETTS: FH-Thaxter s.n., Herb. of F. L. Sargent. MICHIGAN: R.P.K. 1288. MISSOURI: CUP-D 10280 (77-38). NEW HAMPSHIRE: FH-Thalhurve s.n., Sept. 1893. NEW JERSEY: CUP-D 3362 (77-14), 8047 (77-32), CUP 7200. NEW YORK: CUP 581, 2188, 21835, 25692, 28344, 51656-9, 51662-3, 51665, 51667, 51672, 51680-1, 51795, 51827, CUP-A 469, 994, 1365, 1386, 1818, 5271, 5556, 7467, 14868, 15547, CUP-D 453 (77-3), 532 (77-4), 568 (77-10 & 11), 651 (77-12), 692 (77-13), 1035 (77-8), 4071 (77-18), 5659 (77-23), 5660 (77-24), 5661 (77-25), 5684 (77-26), 6965 (77-28), 8049 (77-34), 9093 (77-35), 4522 (77-46), 4523 (77-47), R.P.K. 1693, 2737, 58-65, 58-69. NORTH CAROLINA: CUP 51666, CUP-A 12160, 12162, CUP-D 12160 (77-5), 12162 (77-7). OHIO: CUP-D 8048 (77-33), 10414 (77-39), 10748 (77-44), NY-Cooke 42094, R.P.K. 3968. PENNSYLVANIA: HOLOTYPE of *Peziza chlorascens,* (substrate unknown), Bethlehem, Schweinitz, (no date), PH-Schweinitz Syn. Fung. N. A. 873-130 (= CUP 51669), ISOTYPES, CUP-D 3883 (77-45), 9244 (77-36); CUP 51702, 51704, CUP-A 644. SOUTH CAROLINA: CUP-D 3364 (77-15), UPS-

Fries s.n., (substrate unknown), N. Am. South Carolina, (collector unknown), (date unknown), ut *Chlorosplenium schweinitzii* (=CUP 51736). VERMONT: FH-Linder 538. VIRGINIA: CUP 51703, 51783, CUP-D 5247 (77-22). WEST VIRGINIA: CUP-D 8405 (77-30). WISCONSIN: CUP-D 10721 (77-42), 10726 (77-43), R.P.K. 2781.

CANADA - ONTARIO: R.P.K. 2432, 2447, 3931.

INDONESIA - JAVA: R.P.K.(CUP-SA) 287, 345, 346.

JAMAICA: CUP-D 8044 (77-29).

JAPAN - HONSHU: CUP-JA 182, 185, 192, 224, 1677, 1874, 1875, 2671, 2810, 2958, 2963, 2973. KYUSHU: CUP-JA 423. OKINAWA: CUP-JA 3396, 3431. YAKU ISLAND: CUP-JA 1923, 2093, 2104, 2110.

UNION OF SOVIET SOCIALIST REPUBLICS - RUSSIA: TAA-Parmasto 15471 (=R.P.K. 3334).

Notes: This species is extremely variable and due to the span of coloration it exhibits from yellow through shades of olive-green, specimens when collected separately are likely not to be considered conspecific. The complete range of colors exhibited by this fungus is often observed in apothecia within the same collection, however. Schweinitz, evidently unaware of this color variation, erected a new species, *Peziza chlorascens*, to accommodate a specimen which had a somewhat different color than he had observed in *P. chlora*. Seaver must also have been unaware of the range in color since examination of the type of his *C. olivaceum* shows it to be a specimen which is somewhat darker olive-green, but in all other respects is clearly *C. chlora*.

Seaver (1951) listed *Peziza pomicolor* Berk. & Rav. in Berk., Grevillea 3: 157. 1875, in questionable synonymy with *C. chlora*. I have examined the type of this name from the Berkeley Herbarium at Kew, and while it is immature, it is erumpent and appears to be an immature specimen of a member of the Peziculoideae and possibly a species of *Pezicula*.

This species evidently does not occur in western Europe since no reports are cited in the literature and I have not seen collections of this species from that area of the world.

2. Chlorosplenium hypochlora (Berk. & Curt. ex Phill.) Dixon, *comb. nov.*

≡ *Encoelia hypochlora* Berk. & Curt. ex Phill., Grevillea 19: 107. 1891 (!!).

≡ *Cenangium hypochlorum* (Berk. & Curt. ex Phill.) Sacc., Syll. Fung. 10: 36. 1892.

(Figs. 6-7, 9)

Apothecia: superficial, solitary to gregarious to caespitose, sessile, circular to laterally compressed, at first globose and closed, expanding and becoming cupulate to almost discoid, margins more or less persistently incurved, when dry margins enrolling to the point of often touching.

Disc: < 2 mm in diam., cupulate to convex-expanded, color orange-yellow (Wax Yellow) when rehydrated, drying to a lighter yellow (Mustard Yellow), the disc and medullary tissues separating easily and often completely when old and dry, leaving only the receptacle.

Receptacle: glabrous, ochraceous-brown to olive-brown (Brownish Olive) when rehydrated, drying to brownish grey-black (Blackish Grey), lower portion often vertically ribbed or furrowed, especially upon drying.

Hymenium: 75-100 μm high, hyaline.

Asci: cylindric-clavate, tapering to a short stalk, 70-95 × (5-) 6-8 (-9) μm, J+, 8-spored, apex rounded to subconic, wall at apex 0.5-1.0 μm thick, wall 0.25-0.5 μm thick along the sides of the ascus, maturing successively, arising from repeating croziers.

Ascospores: irregularly biseriate, fusiform-elliptic, hyaline, unicellular, biguttulate, occasionally triguttulate, smooth-walled, (8-) 9-14 (-15) × 2-4 μm.

Paraphyses: filiform, hyaline, blunt at the apex, septate, branching near the base, 2-3 μm in diam., scarcely extending beyond asci.

Subhymenium: 10-20 μm thick, of thin-walled, septate, hyaline to light brown-walled, tight textura intricata, hyphae 1-3 μm in diam.

Medullary Excipulum: of hyaline, thin-walled, loose textura intricata, hyphae 2-3 μm in diam.

Ectal Excipulum: 30-80 μm thick, of dark brown, thick-walled textura angularis to textura globulosa, cells 3-10 × 3-7 μm, walls 0.25-1.0 μm thick, ectal tissue giving rise here and there to hyaline to dark brown, thick-walled hyphae running parallel to the outer surface of the apothecium.

Habitat: on decorticated wood.

Range and Season of Fructification: Cuba, Jamaica, and Mexico; Winter and Spring.

Name: from Greek, "Hypo," beneath, and "Chloris," the green one; referring to the apothecial color.

Type Locality: Lomo del Gaso, Cuba.

Type Specimen: Herb. Berkeley, *Peziza hypochlora* B. C., Cuba, C. Wright, (no date), annotated as Type Number 358, *Encoelia hypochlora* Phillips, K-Berkeley. ISOTYPE specimen: Wright 358, *Peziza hypochlora* Berk. & Curt., dead sticks, Fungi Cub. 690, Feb. 1857, FH (=CUP 52798). ISOTYPE specimen: C. Wright No. 358, *Peziza chlorascens* S., on dead sticks in thick woods, Lomo del Gaso, Fungi Cubenses Wrightiani 690, (no date), FH (=CUP 52725).

Illustrations: none.

Exsiccati: none.

Specimens Examined: CUBA: (substrate unknown), Cuba Orientali, C. Wright, 1856-7, Plantae Cubenses Wrightii s.n., FH (=CUP 52797) [perhaps also an isotype?].

JAMAICA: Korf, Dixon, et al., cut ends of slightly decayed log of *Eucalyptus*, Jan. 8, 1971, CUP-MJ 39; Korf, Dixon, et al., Jan. 17, 1971, CUP-MJ 582.

MEXICO: W.A. & Edna Murrill 422, 7000 ft., near Guernavaca, December 29, 1909, CUP 52724.

Notes: This species closely resembles *C. chlora* in the field, differing on drying and in ascus and spore characters.

EXCLUDED SPECIES AND SYNONYMS

1. CHLOROSPLENIUM AERUGINASCENS (Nyl.) Karst. ≡ *Chlorociboria aeruginascens* (Nyl.) Kan. ex Ram., Korf & Bat., q.v.

2. CHLOROSPLENIUM AERUGINELLUM (Karst.) Karst., Bidrag Kännedom Finlands Natur Folk 19: 104. 1871.
   ≡ *Helotium aeruginellum* Karst., Not. Sällsk. Fauna Fl. Förh. 9: 329. 1868 (!!).
   ≡ *Peziza aeruginella* (Karst.) Nyl., Not. Sällsk. Fauna Fl. Fenn. Förh. 10: 40. 1869.
   ≡[*Chlorociboria aeruginella* (Karst.) Dennis, Mycol. Pap. 62: 48. 1956 (generic name not validly published).]
   ≡ *Chlorociboria aeruginella* (Karst.) Dennis ex Ram., Korf & Bat., Mycologia 49: 859. 1958.

Notes: Examination of specimens and the type of this species shows this fungus to have granulated tomentum hyphae plus an ectal excipulum composed of textura prismatica suggestive of the Hyaloscyphaceae. The correct name of this fungus should be Dasyscyphus aeruginellus (Karst.) Korf & Dixon, *comb. nov.* It should be noted that the fungus is greenish in coloration and does stain the substrate green in localized areas.

Specimens Examined: ENGLAND: on *Filipendula ulmaria*, Sheepfort Farm, Malton, Yorkshire, W. G. Bramley, 5. 10. 1957, K (= CUP 52722); on *Spiraea ulmaria*, Poor's Marsh, Wheatfen Broad, Surlingham, Norfolk, E. A. Ellis, 5-10-1941, K (= R.P.K. 2937 = CUP 52721).

FINLAND: Holotype of *Helotium aeruginellum*, ad Spiraeam *(= Filipendula ulmaria)*, Fennia, Tavastia australis, Tammela, Mustiala, P. A. Karsten, 14. X. 1867, H (= CUP 52633).

3. CHLOROSPLENIUM AERUGINEUM (Berk.) Sacc. = *Chlorociboria aeruginosa* (Pers. per Pers. : Fr.) Seaver ex Ram., Korf & Bat., q.v.

4a. CHLOROSPLENIUM AERUGINOSUM (Oed. per Purton) de Not. = *Chlorociboria aeruginascens* (Nyl.) Kan. ex Ram., Korf & Bat., q.v.

4b. CHLOROSPLENIUM AERUGINOSUM (Pers. per Pers. : Fr.) Auct. ≡ *Chlorociboria aeruginosa* (Pers. per Pers. : Fr.) Seaver ex Ram., Korf & Bat., q.v.

5. CHLOROSPLENIUM AMENTICOLUM Karst., Rev. Mycol. (Toulouse) 9: 11. 1887 (!!).
    ≡ *Ciboria amenticola* (Karst.) Boud., Hist. Class. Discom. d'Europe p. 106. 1907.
  = *Peziza viridi-fusca* Fckl., Jahrb. Nassauischen Vereins Naturk. 23-24: 309. 1870.
    ≡ *Phialea viridi-fusca* (Fckl.) Sacc., Syll. Fung. 8: 275. 1889.
    ≡ *Ciboria viridi-fusca* (Fckl.) v. Höhn., Mitt. Bot. Lab. TH Wien 3: 101. 1926.
  = *Helotium amenti* (Batsch per Pers. : Fr.) f. *alni* Sacc., Michelia 2: 612. 1882 (!!).
  = *Ombrophila baeumleri* Rehm (ut "Baümleri"), Ascom. Exs. No. 806. 1885; Hedwigia (ut "Bäumleri") 24: 228. 1885 (!!).
    ≡ *Helotium baeumleri* (Rehm) Syd., Mycotheca Marchica Exs. No. 4047. 1894.

Notes: Examination of Karsten's type specimen shows it to agree with specimens and the type of *Ombrophila baeumleri* Rehm. Dennis (1968) synonymizes this latter species with *Peziza viridi-fusca* Fckl., and although I have not examined the type of that species, I accept his synonymy, so that the correct name of the fungus would appear to be *Ciboria viridi-fusca* (Fckl.) v. Höhn.

Specimens Examined: FRANCE: Holotype of *Chlorosplenium amenticolum*, *Alnus glutinosus*, [prope Rouen], [Letendre], (date unknown), H-Karsten 898 (=CUP 52634); Holotype of *Helotium amenti* f. *alni*, *Alnus glutinosus*, [Rouen], [Letendre], (date unknown), PAD-Saccardo s.n. (=CUP 51742).

GERMANY: a faul. Fruchtzapfen v. *Alnus glut.*, gr. Winterberg, G. Wagner, Nov. 92, S; an den Fruchthallen von *Alnus glutinosa*, Lee bei Berlin, Sydow, 9. 1885, S; an *Alnus incana*, Berlin, Sydow, 10. 1893, S; Sydow, Mycotheca Marchica Exs. No. 972 (ut *Ombrophila baeumleri*), S; No. 1783 (ut *Helotium amenti*), S; No. 4047 (ut *Helotium baeumleri*), S, FH.

HUNGARY: Isotypes of *Ombrophila baeumleri*, an faulenden *Alnus*-Zapfen, bei Pressberg, Bäumler, M/1883/84, Rehm, Ascomyceten Exs. No. 806, S-Rehm (=CUP 51743), CUP-D 4935 (118-8).

6. [CHLOROSPLENIUM ATROVIRENS (Pers. per Pers. : Fr.) de Not. ex Karst. (ut "atro-virens"), Bidrag Kännedom Finlands Natur Folk 19: 93. 1871 (pro synon. sub *Ombrophila atrovirens* (Pers. per Pers. : Fr.) Karst.)]
   ≡[*Peziza atrovirens* Pers., Syn. Meth. Fung. p. 635. 1801.]
   ≡[*Ascobolus atrovirens* (Pers.) Nees, Das System der Pilze und Schwämme p. 269. 1816.]
   ≡ *Peziza atrovirens* Pers. per Pers. (ut "atro-virens"), Myc. Eur. 1: 306. 1822, : Fries, Syst. Mycol. 2(1): 141. 1822.
   ≡ *Calloria atrovirens* (Pers. per Pers. : Fr.) Fr., Summa Veg. Scand. p. 359. 1849.
   ≡ *Ombrophila atrovirens* (Pers. per Pers. : Fr.) Karst., Bidrag Kännedom Finlands Natur Folk 19: 92. 1871.
   ≡ *Mollisia atrovirens* (Pers. per Pers. : Fr.) Gill. (ut "atro-virens"), Champ. Fr. Disc. (Liv. 5), p. 126. 1882.
   ≡ *Tympanis atrovirens* (Pers. per Pers. : Fr.) Rehm, Hedwigia 20: 70. 1882.
   ≡ *Coryne atrovirens* (Pers. per Pers. : Fr.) Boud., Bull. Soc. Mycol. France 1: 114. 1885.
   ≡ *Chlorospleniella atrovirens* (Pers. per Pers. : Fr.) Kuntze, Revis. Gen. Pl. 2: 848. 1891.
   ≡ *Corynella atrovirens* (Pers. per Pers. : Fr.) Boud., Hist. Class. Discom. d'Europe p. 99. 1907.
   ≡ *Claussenomyces atrovirens* (Pers. per Pers. : Fr.) Korf & Abawi, Canad. J. Bot. 49: 1882. 1971.
 = *Coryne virescens* Tul. & Tul., Sel. Fung. Carpol. 3: 177. 1865.
   ≡[*Tremella virescens* Schum., Enum. Pl. Saell. 2: 439. 1803. (Stat. conid.)]
   ≡[*Dacrymyces virescens* (Schum.) per Fr., Syst. Mycol. 2(1): 229. 1822. (Stat. conid.)]
   ≡ *Chlorosplenium virescens* (Tul. & Tul.) Cooke, Bull. Buffalo Soc. Nat. Sci. 2: 299. 1875.

Notes: While I have not examined the type of this species, Korf and Abawi (1971) have recently treated it as a member of the genus *Claussenomyces*, and I accept their placement. Hence, the correct name of this fungus would appear to be *C. atrovirens* (Pers. per Pers. : Fr.) Korf & Abawi.

Specimen Examined: Petrak, Flora Bohemiae et Moraviae Exs. No. 234 (ut *Chlorosplenium aeruginosum*), BPI (=CUP 52707).

7. [CHLOROSPLENIUM ATROVIRIDE Bres. ex Rick (ut "atro-viride"), Ann. Mycol. 4: 311. 1906 (!!), nomen nudum.]
   = *Bulgariella foliacea* Starb., Arch. Bot. (Leipzig) 2(5): 7. 1904.
      ≡ *Chlorosplenium foliaceum* (Starb.) Rick, Brotéria, Sér. Bot. 25: 98. 1931.

Notes: Examination of an "isotype" of Bresadola's *nomen nudum* shows it to have a strongly ionomidotic reaction in KOH, the pore to be J-, and the ectal excipulum to be that of a member of the Encoelioideae. It is surely a member of the genus *Cordierites* Mont. sensu Korf (1973). In 1931 Rick synonymized this *nomen nudum* with *Bulgariella foliacea*. I have not been able to locate the type of this latter species; its original description gives every indication of being a *Cordierites*, as do Starbäck's illustrations. Both the original description and the illustrations fit in many respects the "isotype" I have examined of *C. atroviride*. Transfer of Starbäck's epithet to *Cordierites* awaits monographic study of that genus.

Specimens Examined: BRASIL: "Isotype" of *Chlorosplenium atroviride*, Rick, Fungi Austro-Americani No. 64, in truncis socio *Hypoxlyo*, São Leopoldo, Rick, 1905, BPI (=CUP 51715); (substrate unknown), São Leopoldo, Brazil, Rick, 1929, BPI (=CUP 51717); Theissen, Decades Fungorum Brasiliensium No. 279, BPI (=CUP 51716); Torrend s.n., S. Leopoldo, Rick, 1908, CUP-D 9590 (76-80).

8. CHLOROSPLENIUM BRASILIENSE Berk. & Cooke ≡ *Chlorociboria aeruginascens* (Nyl.) Kan. ex Ram., Korf & Bat. subsp. *brasiliensis* (Berk. & Cooke) Dixon, q.v.

9. CHLOROSPLENIUM BULGARIOIDES (Rabenh.) Karst., Not. Sällsk. Fauna Fl. Fenn. Förh. 11: 233. 1870.
   ≡ *Peziza bulgarioides* Rabenh., Fungi Europaei Exs. No. 1008. 1866; Hedwigia 6: 45. 1867 (!!).
   ≡ *Rutstroemia bulgarioides* (Rabenh.) Karst., Bidrag

Kännedom Finlands Natur Folk 19: 105. 1871.

≡ *Humaria bulgarioides* (Rabenh.) Sacc., Syll. Fung. 8: 149. 1889.

≡ *Ciboria bulgarioides* (Rabenh.) Boud., Hist. Class. Discom. d'Europe p. 106. 1907.

≡ *Piceomphale bulgarioides* (Rabenh.) Svrček, Česká Mykol. 11: 240. 1957.

≡ *Chlorociboria bulgarioides* (Rabenh.) Ram., Korf & Bat., Mycologia 49: 860. 1958.

=[*Peziza abietis* ββ *strobilina* Alb. & Schw., Consp. Fung. p. 342. 1805.]

≡ [*Peziza strobilina* (Alb. & Schw.) DC., Fl. Fr. 6: 21. 1815.]

≡ *Cenangium ferruginosum* Fr. β *strobilina* (Alb. & Schw.) per Fr., Syst. Mycol. 2(1): 187. 1822.

≡ *Ciboria strobilina* (Alb. & Schw. per Fr.) Boud., Icon. Mycol. Explic. Planches, Sér. 4, p. 18. 1907, non *Ciboria strobilina* (Alb. & Schw.) Sacc. 1889.

≡ [*Chlorociboria strobilina* (Alb. & Schw. per Fr.) Seaver, Mycologia 28: 39. 1936 (genus not validly published).]

=[*Peziza versiformis* ββ *livida* Alb. & Schw., Consp. Fung. p. 314. 1805.]

≡[*Peziza versiformis* Pers. per Pers. var. β *livido-purpurascens* Pers., Myc. Eur. 1: 243. 1822 (gratuitous renaming).]

≡ *Peziza versiformis* Pers. per Pers. : Fr. var. β *livido-purpurascens* Pers. : Fr. (ut "A.S."), Syst. Mycol. 2(1): 131. 1822.

≡ *Helotium versiforme* (Pers. per Pers. : Fr.) Fr. var. *livido-purpurascens* (Pers. per Pers. : Fr.) Gill. (ut "A.S."), Champ. Fr., Disc. (Liv. 6) p. 158. 1883.

≡ *Chlorosplenium lividum* (Alb. & Schw.) per Karst., Acta Soc. Fauna Fl. Fenn. 2: 124. 1885.

≡ *Ciboria livida* (Alb. & Schw. per Karst.) Boud., Hist. Class. Discom. d'Europe p. 106. 1907.

≡ *Ombrophila livida* (Alb. & Schw. per Karst.) Lind, Danish Fung. p. 123. 1913.

= *Peziza versiformis* Pers. per Pers. : Fr. β *nigrescente-olivascens* Weinm., Hymeno. Gasterom. Imp. Ross. p. 467. 1836.

≡ *Chlorosplenium nigrescente-olivaceum* (Weinm.) Karst., Meddeland. Soc. Fauna Fl. Fenn. 9: 56. 1883.

= *Cenangium strobilinum* Sacc., Fungi ital. autogr. del., tab. 1306. 1883.

= *Ciboria strobilina* (Alb. & Schw. per Fr.) Boud. var. *bresadolae* Boud., Icon. Mycol. Explic. Planches, Sér 4, p.

18. 1907.

Notes: The nomenclature of this species is extremely confused in the literature due to the misapplication of the specific epithet "strobilina." There are at least three fungi that occur on the cones of *Picea* and while clearly distinct taxonomically, they have been confused nomenclaturally. This species is based on *Peziza bulgarioides* Rabenh., and seems to occur only on *Picea* cones. It appears to have been first described as a variety of *Peziza abietis* by Albertini and Schweinitz (1805), but was not raised to specific rank until 1907 by Boudier, long after Rabenhorst's establishment of *P. bulgarioides*. Karsten later (1871) made *P. bulgarioides* the first species in his genus *Rutstroemia*, and Honey (1928) typified *Rutstroemia* by this species. This fungus has asci (65-) 70-85 × 6.0-7.5 µm, ellipsoid spores 6-9 × 3-5 µm, and in section the apothecium has globose cells as the outermost layer of the ectal excipulum. Dr. Kent Dumont *(pers. comm.)* has found that this fungus has a stroma and should be included in the Sclerotiniaceae. The correct name for this species appears to be *Rutstroemia bulgarioides* (Rabenh.) Karst.

While I have not examined the type specimen of *Peziza versiformis* ββ *livida* Alb. & Schw., I follow Karsten (1869, 1885), Saccardo (1889), Rehm (1891), Lind (1913), and Seaver (1936, 1951) in placing this variety in synonymy with *P. bulgarioides*.

In 1805 Albertini and Schweinitz also established a second variety "strobilina," *Peziza tuberosa* ββ *strobilina*, and this fungus is synonymous with *Peziza rufo-fusca* Weberb. For synonymy, see excluded species #9a, below.

To add to the already very confused nomenclatural position of these two fungi, there is a third species which occurs on the cones of *Pinus* and *Picea* and is based on a Friesian species, *Peziza strobilina*. This species is clearly a *Cyathicula;* its synonymy is given under #9b, below.

Specimens Examined: U.S.A. - WASHINGTON: BPI-Cooke 26879.

CZECHOSLOVAKIA: Krypt. Exs. No. 204 (ut *Ombrophila strobilina*), CUP-D 4848 (118-47).

DENMARK: CP-Rostrup s.n., 25. 5. 1889.

FINLAND: in strobilis *Piceae excelsae*, 22. X. 1868, (collector and locality unknown) (ut *Chlorosplenium lividum*) (no apothecia found), H-Karsten 899; Karsten, Fungi Fenniae Exs. No. 631 (ut *Peziza bulgarioides*), FH; de Thümen, Mycotheca Universalis No. 1113 (ut *Chlorosplenium bulgarioides*), BPI.

GERMANY: Sydow, Mycotheca Germanica No. 332 (ut *Ombro-*

phila strobilina), CUP-D 9762 (118-50), BPI; FH-Plattner s. n., April 1899.

HUNGARY: Isotype of *Peziza bulgarioides*, Rabenhorst, Fungi Europaei No. 1008, strobilos *Pinorum*, Carpathis Hungariae, C. Kalchbrenner (no date), CUP; Rabenhorst, Fungi Europaei No. 1311 (ut *Peziza bulgarioides*), BPI; Linhart, Flora Hungarica Exs. No. 609 (ut *Ombrophila strobilina*), FH.

JAPAN - HOKKAIDO: CUP-JA 809, 882.

SWITZERLAND: Herbier Barbey-Boissier No. 1285 (ut *Coryne versiformis*), BPI, FH; de Thümen, Mycotheca Universalis No. 217 (ut *Helotium versiforme*) FH (=CUP 52693).

LOCALITY UNKNOWN: Rehm, Ascom. Exs. No. 1005 (ut *Ombrophila strobilina*), CUP-D 8536 (118-49); BPI-Sbarbaro 138.

9a. CIBORIA RUFO-FUSCA (Weberb.) Sacc., Syll. Fung. 8: 203. 1889.

≡ *Peziza rufo-fusca* Weberb., Pilze Nord-Deuts. 1: 7. 1873.

=[*Peziza tuberosa* Hedw. ββ *strobilina* Alb. & Schw., Consp. Fung. p. 313. 1805.]

≡ *Peziza tuberosa* Hedw. per Mérat : Fr. [var.] b. *strobilina* Alb. & Schw. per Fr., Syst. Mycol. 2(1): 58. 1822.

≡ *Phialea strobilina* (Alb. & Schw. per Fr.) Quél., Bull. Soc. Bot. France 25: 287. 1878, non *Phialea strobilina* (Fr.) Gill. 1881.

≡ *Ciboria strobilina* (Alb. & Schw. per Fr.) Sacc., Syll. Fung. 8: 203. 1889.

≡ *Ombrophila strobilina* (Alb. & Schw. per Fr.) Rehm, in Rabenhorst's Krypt-Fl. 1(3) (Lief. 35): 482. 1891, non *O. strobilina* (Fr.) Karst. 1871.

≡[*Chlorociboria strobilina* (Alb. & Schw. per Fr.) Seaver, Mycologia 28: 39. 1936 (genus not validly published, and the name misapplied).]

Notes: This fungus occurs on cones of *Picea, Abies,* and *Pseudotsuga,* has asci (55-) 65-85 (-95) × (4.5-) 5-6 (-7) µm, broadly ellipsoid spores 4-6 (-7) × 2-3.5 µm, is reddish brown in the fresh state (never green), and has an ectal excipulum of textura angularis to textura globulosa. I agree with Groves and Elliott (1969) that this is a *Ciboria* and the correct name appears to be *Ciboria rufo-fusca* (Weberb.) Sacc.

Specimens Examined: AUSTRIA: Rehm, Ascom. Exs. No. 1554 (ut *Ciboria rufo-fusca*), CUP-D 11893 (78-71).

GERMANY: Krieger, Fungi Saxonici No. 678 (ut *Ombrophila strobilina*), CUP.

JAPAN - HOKKAIDO: CUP-JA 864.

9b. PEZIZA STROBILINA Fr., Syst. Mycol. 2(1): 125. 1822.
≡ *Helotium strobilinum* (Fr.) Fckl., Jahrb. Nassauischen Vereins Naturk. 23-24: 313. 1870.
≡ *Ombrophila strobilina* (Fr.) Karst., Bidrag Kännedom Finlands Natur Folk 19: 92. 1871.
≡ *Phialea strobilina* (Fr.) Gill., Champ. Fr., Disc. (Liv. 4), p. 103. 1881, non *Phialea strobilina* (Alb. & Schw. per Fr.) Quél. 1878.
≡[*Phialea strobilina* (Fr.) Sacc. nec Gill., Syll. Fung. 8: 256. 1889 (attempted taxonomic correction).]
≡ *Phialea eustrobilina* Korf in Ram., Korf & Bat., Mycologia 49: 861. 1958.

Notes: While I have not examined the type of this species, the specimens I have seen occur on *Picea* and *Pinus*, have asci 45-55 × 4-5 µm, ellipsoid ascospores 8-10 (-12) × 1.5-2 µm, are brownish in the fresh state and have a cyathiculoid ectal excipulum. For an excellent description of this species see Dennis (1956). The fungus appears to be a member of the genus *Cyathicula* de Not. sensu Korf (1973). Hence, we propose the correct name of it to be Cyathicula strobilina (Fr.) Korf & Dixon, *comb. nov.*

Specimens Examined: FRANCE: Roumeguère, Fungi Gallici Exs. No. 2168 (ut *Ombrophila*), CUP-D 11463 (118-46).

GERMANY: Rehm, Ascom. Exs. No. 703 (ut *Ombrophila*), CUP-D 4963 (118-48).

NETHERLANDS: Rabenhorst, Fungi Europaei Exs. No. 624 (ut *Peziza*), CUP.

LOCALITY UNKNOWN: Rabenhorst, Fungi Europaei Exs. No. 222 (ut *Peziza*), CUP.

10. CHLOROSPLENIUM CAESIO-LUTEUM (Berk. & Br.) Dennis, Kew Bull. 17: 376. 1963.
≡ *Peziza caesio-lutea* Berk. & Br., J. Linn. Soc. Bot. 14: 106. 1873 (!!).
≡ *Trichopeziza caesio-lutea* (Berk. & Br.) Sacc., Syll. Fung. 8: 412. 1889.

Notes: Examination of the type of this species shows that it is closely related to *Lachnum viridulum* Massee & Morg. as concluded by Dennis (1963), to which reference is made under excluded species #41, below. The gelatinized ectal excipulum composed of textura prismatica and the presence of granular, roughened tomentum hyphae indicate that this species fits best in the Trichoscyphelloideae or Hyaloscyphoideae. I choose not to designate a generic position for it until further taxonomic work is completed.

Specimen Examined: CEYLON: Holotype of *Peziza caesio-*

lutea, (substrate unknown), Central Province, Thwaites 1053, Dec. 1868, K-Berkeley (=CUP 51756).

11. CHLOROSPLENIUM CANADENSE Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 41: 146. 1893 (!!).
    = *Holwaya mucida* (Schulzer) Korf & Abawi, Canad. J. Bot. 49: 1880. 1971.

Notes: Korf & Abawi (1971) have recently treated this species as a synonym of *Holwaya mucida*. I agree after examination of an isotype specimen and other collections.

Specimens Examined: CANADA - ONTARIO: Isotypes of *C. canadense*, on bark of *Tilia*, London, Canada, Dearness 2032, Oct. 3, '92, CUP-D 4521 (109-188), 2063 (109-182); CUP-D 2064 (109-183), 2065 (109-184), 4524 (109-189).
U.S.A. - OHIO: Ellis & Everhart, Fungi Columbiani No. 1216 (ut *Dacryopsis ellisiana*), CUP.

12. CHLOROSPLENIUM CHLOROMELUM (Phill. & Hark.) Sacc., Syll. Fung. 8: 319. 1889.
    ≡ *Peziza chloromela* Phill. & Hark., Grevillea 13: 22. 1884 (!!).
    ≡ *Chloroscypha chloromela* (Phill. & Hark.) Seaver, Mycologia 23: 250. 1931.
    ≡ *Kriegeria chloromela* (Phill. & Hark.) Seaver, Mycologia 35: 493. 1943.

Notes: Examination of an isotype specimen shows clearly that Seaver (1931) was correct in considering this species as a member of the genus *Chloroscypha*.

Specimen Examined: CALIFORNIA: Isotype of *Peziza chloromela*, *Sequoia sempervirens*, Harkness 1951, (date unknown), CUP-D 3764 (77-49).

13. CHLOROSPLENIUM CHRYSOTRICHUM (Berk.) Dennis, Kew Bull. 15: 313. 1961.
    ≡ *Peziza chrysotricha* Berk. in J. D. Hooker's Bot. Ant. Voy. H. M. Disc. Erebus & Terror II: Fl. Nov.-Zelandiae 2: 201. 1855 (!!).
    ≡ *Trichopeziza chrysotricha* (Berk.) Sacc., Syll. Fung. 8: 411. 1889.

Notes: I have examined the type in the Berkeley herbarium and due to its very fragmentary condition decided not to section the only remaining apothecium. I did remove a small piece of the edge of the apothecium, and squashed it in 100% glycerine. From the shape of the spores and the presence of large, globulose cells I conclude this is a possible member of the Encoelioideae, perhaps close to *Velutarina* Korf. I did not observe in this squash mount the granular, roughened hyphae protruding from the ectal excipulum as reported and illustrated by Dennis (1961). His illustrations remind one of the Hyaloscyphaceae.

The ascospores I have measured had a range of 14-17 × 4-5 µm, were pigmented yellow, and matched the shape reported by Dennis. The asci were thin-walled at the apex and ranged in size from 75-96 × 8-12 µm. The sporiferous portion of the ascus was 60-65 µm with the spores arranged in an irregularly biseriate condition. I would agree with Dr. Dennis when he wrote: "This beautiful species was fully described by Massee (in Journ. Linn. Soc., Bot. 31: 517 (1896)), but its systematic position still presents some difficulty." I am not certain as to the generic disposition of this species, but it is surely not a *Chlorosplenium*.

Specimen Examined: NEW ZEALAND: Holotype of *Peziza chrysotricha*, on twigs, shores of Waikare Lake, Colenso, 1843, K-Berkeley s.n. (=CUP 51755).

14. CHLOROSPLENIUM DISCOIDEUM Massee = *Chlorociboria aeruginosa* (Pers. per Pers. : Fr.) Seaver ex Ram., Korf & Bat., q.v.

15. CHLOROSPLENIUM ELATINUM (Alb. & Schw. per Pers. : Fr.) Sacc., Syll. Fung. 8: 318. 1889.
    ≡[*Peziza elatina* Alb. & Schw., Consp. Fung. p. 330. 1805.]
    ≡ *Peziza elatina* Alb. & Schw. per Pers., Myc. Eur. 1: 291. 1822, : Fr., Syst. Mycol. 2(1): 112. 1822.
    ≡ *Helotium elatinum* (Alb. & Schw. per Pers. : Fr.) Quél., Ench. Fung. p. 309. 1886.
    ≡ *Rutstroemia elatina* (Alb. & Schw. per Pers. : Fr.) Rehm, in Rabenh. Krypt.-Fl. 1(3) (Lief. 39): 767. 1893.
  = *Ombrophila ? kriegeriana* Rabenh., Fungi Eur. Exs. No. 2315. 1878; Hedwigia 17: 31. 1878 (!!).
    ≡ *Kriegeria olivacea* Rabenh., Hedwigia 17: 32. 1878.
    ≡ *Ciboria kriegeriana* (Rabenh.) Rehm, Ascom. Exs. No. 660. 1883; Hedwigia 22: 36. 1883.
    ≡ *Chlorosplenium kriegerianum* (Rabenh.) Sacc., Syll. Fung. 8: 318. 1889.

Notes: While it has not been possible to examine the type of *Peziza elatina* Alb. & Schw., the illustration of Albertini and Schweinitz in their "Conspectus fungorum in Lusatiae" leaves no doubt that this is synonymous with *Ombrophila kriegeriana* Rabenh. Examination of an isotype specimen of this latter species leaves me no doubt that *O. kriegeriana* would today be considered as a member of the genus *Poculum* Vel. I choose not to make a new combination since Dr. Dumont *(pers. comm.)* is prepared to do so in a forthcoming publication.

Specimens Examined: FRANCE: Roumeguère, Fungi Gallici Exs. No. 3934 (ut *Ombrophila kriegeriana*), FH.
GERMANY: Isotype of *Ombrophila ? kriegeriana,* Rabenhorst, Fungi Europaei Exs. No. 2315, FH, CUP-D 8529 (78-53); Rabenhorst, Fungi Europaei Exs. No. 2315b (supplement) (ut *O. kriegeriana*), FH; Rehm, Ascom. Exs. No. 660 (ut *Ciboria kriegeriana*) FH (=CUP 52699), CUP-D 4546 (78-52); de Thümen, Mycotheca Universalis No. 2117 (ut *Ombrophila kriegeriana*), FH.

16. CHLOROSPLENIUM EPIMYCES Cooke, Bull. Buffalo Soc. Natl. Sci. 2: 299. 1875 (!!).
≡ *Ascobolus epimyces* (Cooke) Seaver, N. Amer. Cup-Fungi (Opercul.) p. 91. 1928.

Notes: I have examined the type of this species and concur with Seaver (1928) and van Brummelen (1967) that the correct name for this fungus is *Ascobolus epimyces* (Cooke) Seaver.

Specimens Examined: U.S.A. - NEW JERSEY: Lectotype of *C. epimyces,* on rotten wood covered with slime mould, Newfield, Ellis 1010, (date unknown: ? July 1874), NY-Ellis, designated lectotype by van Brummelen (1967); Isolectotype, CUP-D 4525 (77-51).

17. [CHLOROSPLENIUM FLAVOVIRENS Massee in Dennis, Kew Bull. 15: 306. 1961, *nomen nudum,* pro synon.] Cfr. notes under excluded species #19, below.

18. CHLOROSPLENIUM FOLIACEUM (Starb.) Rick = *? Cordierites* sp.; for complete synonymy, see excluded species #7, above.

19. CHLOROSPLENIUM FUEGIANUM Speg., Bol. Acad. Nac. Ci. (Córdoba) 11: 266. 1887 (!!).
≡ *Helotium magellanicum* Dennis, Kew Bull. 15: 305. 1961, non *Helotium fuegianum* Speg. 1887.

Notes: I have examined the type of this species and find that it has a distinctly toothed margin and a cyathiculoid exciple which would place it in the genus *Cyathicula.* Its correct name is **Cyathicula fuegiana** (Speg.) Korf & Dixon, *comb. nov.*

I have also examined a specimen from New Zealand ex Kew Herbarium (Colenso 396, =CUP 51748) labelled *Chlorosplenium flavovirens* Massee (a nomen nudum) and disagree with Dr. Dennis (1961) that this specimen is conspecific with *C. fuegianum* Speg. The Massee specimen has ascospores that are 10-12.5 × 3-5 µm and does not have a toothed margin, whereas the type of *C. fuegianum* has ascospores 12-15 × 5-6 µm and a toothed margin. I feel certain that the Massee specimen is also a *Cyathicula,* but to which species it should be referred I am not prepared to say.

Specimens Examined: ARGENTINA: Holotype of *Chlorosplenium fuegianum, Fagus betuloides,* Isla de los Estados, Port Vancouver, C. Spegazzini, III 1882, LPS (=CUP 52635); Isotype, BA (=CUP 51747).

19a. CHLOROSPLENIUM INDICUM Singh (ut "Dumont, Korf & Singh," *lapsus calami*), Trans. Brit. Mycol. Soc. 63: 293. 1974 = *Chlorociboria aeruginascens* (Nyl.) Kan. ex Ram., Korf & Bat. subsp. *aeruginascens,* q.v.

20. CHLOROSPLENIUM KRIEGERIANUM (Rabenh.) Sacc. = ? *Poculum* sp.; for complete synonymy see excluded species #15, above.

21. CHLOROSPLENIUM LIVIDUM (Alb. & Schw.) per Karst. = *Rutstroemia bulgarioides* (Rabenh.) Karst.; for complete synonymy, see notes under excluded species #9a, above.

22. CHLOROSPLENIUM MELATHEJA (Fr.) Dennis, Kew Bull. 26: 476. 1972.
≡ *Peziza melaxantha* Fr., Syst. Mycol. 2(1): 97. 1822, non *P. melaxantha* Fr., Syst. Mycol. 2(1): 150. 1822.
≡ *Peziza melatheja* Fr., Syst. Mycol. 2(2): 611 (index) and corrigenda (unnumbered sheet). 1823.
≡ *Lachnella melaxantha* (Fr.) Phillips, Manual Brit. Discom. p. 266. 1887.
≡ *Trichopeziza melaxantha* (Fr.) Sacc., Syll. Fung. 8: 428. 1889.
≡ *Dasyscyphus melaxanthus* (Fr.) Massee (ut *Dasyscypha melaxantha*), Brit. Fungus-Fl. 4: 353. 1889.
≡ *Urceolella melaxantha* (Fr.) Boud., Hist. Class. Discom. d'Europe p. 130. 1907.

Notes: This species was recently treated by Dennis (1972) as a member of the genus *Chlorosplenium.* Neither Dennis nor I have been able to examine the type specimen. The illustration by Dennis of a specimen collected on the Isle of Mull does not suggest the affinities with *C. chlora* that he proposed, which has an exciple composed of hyaline to brown-walled textura angularis to textura globulosa, never composed of textura prismatica as the illustration by Dennis clearly shows. I agree with Dennis that this species has several features in common with *Helotium aeruginellum* Karst., but examination of the type and other specimens of that species shows it to be a member of the genus *Dasyscyphus,* treated above as excluded species #2. Dennis also concluded that this species is closely related to *Lachnum viridulum,* but I find that species to have a highly gelatinized ectal excipulum and to show close affinities with the Trichoscyphelloideae (see comments under excluded species #41, below). Hence, on the basis of the original description and the description given by Dennis, it would appear Massee was correct in placing this species in the genus *Dasyscyphus,* and that the correct name should be Dasyscyphus melatheja (Fr.) Dixon, *comb. nov.*

23. CHLOROSPLENIUM MICROSPERMUM Henn. = *? Chlorociboria aeruginascens* (Nyl.) Kan. ex Ram., Korf & Bat. subsp. *brasiliensis* (Berk. & Cooke) Dixon, q.v.

24. CHLOROSPLENIUM NIGRESCENTE-OLIVACEUM (Weinm.) Karst. = *Rutstroemia bulgarioides* (Rabenh.) Karst.; for complete synonymy, see excluded species #9, above.

25. CHLOROSPLENIUM OLIVACEUM Rick, Brotéria, Sér. Bot. 25: 98. 1931 (!!), non *C. olivaceum* Seaver, 1951.

Notes: I have been able to examine the type specimen of this species through the courtesy of Father Sehnem in Brasil and find that it has a definite stroma and is without question a member of the Sclerotiniaceae, possibly a member of the genus *Poculum* Vel. Since the specimen is scanty and the species is clearly not a member of the genera *Chlorosplenium, Chlorociboria,* or *Chlorencoelia,* I did not section the only apparently well-preserved apothecium in the packet, preferring to leave this task to a specialist in the Sclerotiniaceae.

Specimen Examined: BRASIL: Holotype of *Chlorosplenium olivaceum,* in ligno frondoso, São Leopoldo, Braun, 1929, Rick Herbarium, Universidade do Vale do Rio dos Sinos, UNISINOS, São Leopoldo, Rio Grande do Sul, Brasil.

26. CHLOROSPLENIUM OLIVACEUM Seaver (non *C. olivaceum* Rick) = *Chlorosplenium chlora* (Schw. : Fr.) Curtis in Sprague, q.v.

27. CHLOROSPLENIUM OMNIVIRENS (Berk.) Cooke ≡ *Chlorociboria omnivirens* (Berk.) Dixon, q.v.

28. CHLOROSPLENIUM PUIGGARII Speg. = *Chlorociboria aeruginascens* (Nyl.) Kan. ex Ram., Korf & Bat. subsp. *brasiliensis* (Berk. & Cooke) Dixon, q.v.

29. CHLOROSPLENIUM REPANDUM Fr. = *Chlorosplenium chlora* (Schw. : Fr.) Curtis in Sprague, q.v.

30. CHLOROSPLENIUM RODWAYI Korf = *Chlorencoelia torta* (Schw.) Dixon, q.v.

31. CHLOROSPLENIUM RUGIPES (Peck) Korf = *Chlorencoelia torta* (Schw.) Dixon, q.v.

32. CHLOROSPLENIUM SALVIICOLOR Ellis & Everh., Proc. Acad. Sci. Philadelphia 45: 146. 1893 (!!).

Notes: Examination of the type specimen of this species shows it has a medullary excipulum composed of gelatinized hyphae and an ectal excipulum composed of parallel hyphae embedded in a gel running to the margins. I feel this species represents a member of the genus *Claussenomyces* Kirschst. despite the fact that the ascospores are unicellular, and hence propose the correct name of this fungus should be Claussenomyces salviicolor (Ellis & Everh.) Korf & Dixon, *comb. nov.* It should be noted that this species stains the substrate green in very localized areas at the bases of the apothecia. I have examined two other specimens which appear to be either conspecific with *C. salviicolor* or extremely close to it.

Seaver's (1951) description adds nothing to that of the original diagnosis, appearing to be little more than a paraphrase of it. He inexplicably credited the name to "Ellis & Dearness." I find the ascospores to be 3-4 × 1 μm, and the asci to be 35-40 × 3-4 μm.

Specimens Examined: U.S.A. - LOUISIANA: Holotype of *Chlorosplenium salviicolor*, on dead *Vitis*, Langlois 1679, (no date), NY (=CUP 51723); Isotypes, CUP-D 4527 (77-55), FH. NEW YORK: on *Carpinus caroliniana*, Hendershot Gulf, stage 28, Alpine, Schuyler Co., R. P. Korf and students, 20. V. 1963, R.P.K. 3231.

DOMINICA: (substrate unknown), Layneo Road, A. L. Welden 1876, (no date), CUP-DO 317.

33. CHLOROSPLENIUM SCHWEINITZII Fr. ≡ *Chlorosplenium chlora* (Schw. : Fr.) Curtis in Sprague, q.v.

34. CHLOROSPLENIUM SERICEUM (Alb. & Schw. per Pers. : Fr.) Boud., Hist. Class. Discom. d'Europe p. 110. 1907.
≡[*Peziza sericea* Alb. & Schw., Consp. Fung. p. 325. 1805.]
≡ *Peziza sericea* Alb. & Schw. per Pers., Myc. Eur. 1: 261. 1822, : Fr., Syst. Mycol. 2(1): 93. 1822 (!).
≡ *Erinella sericea* (Alb. & Schw. per Pers. : Fr.) Quél., Ench. Fung. p. 301. 1886.
≡ *Dasyscyphus sericeus* (Alb. & Schw. per Pers. : Fr.) Sacc. (ut *Dasyscypha sericea*), Syll. Fung. 8: 456. 1889.
= ? *Erinella aeruginosa* Henn., Hedwigia 45: 30. 1905 (!!).
≡ *Dasyscyphella aeruginosa* (Henn.) Jacz., in Kursanov, Opredel. nizschikh rast. 3, Griby: 386. 1954.

Notes: I have been unable to locate the type specimen of *Peziza sericea,* but I have examined a North American specimen from the Schweinitz Herbarium [PH-Schweinitz, Syn. #802 (=CUP 51741)] deposited under this name and find that it is a member of the genus *Dasyscyphus* S. F. Gray with ascospores 5-6 × 2 µm.

Through the courtesy of Dr. Raĭtviĭr, I was able to examine a specimen from Poland which fits the description and probable isotype specimen of *Erinella aeruginosa* Henn. This specimen has ascospores 39-43 × 3-4 µm. The similarities of the latter species with the description and illustration of *P. sericea* given by Albertini and Schweinitz (1805) is remarkable. I exclude *P. sericea* from the genus *Chlorosplenium* on the basis of the original description and illustration and the discussions of other authors who have handled this species, i.e., Persoon (1822), Fries (1822), Quélet (1886), Rehm (1893), and Boudier (1907). While I feel strongly that the fungi described by Hennings and by Albertini and Schweinitz are conspecific, I choose not to synonymize them until further work is done on the genus and/or the type of *P. sericea* is found or the species is neotypified. This species (which I refer to *Dasyscyphus*) stains the wood upon which it grows green in localized areas near the apothecia.

Specimens Examined: POLAND: on decaying wood, Augustow, D. A. Dura, 3. IX. 1966, TAA-Dura 60492 (=CUP 52629).

SWITZERLAND: on decorticated oak wood, Geneva, M. F. Steffen, 1967, R.P.K. 3581 (comm. R.W.G. Dennis).

UNION OF SOVIET SOCIALIST REPUBLICS - RUSSIA: Probable isotype of *Erinella aeruginosa,* auf *Quercus pedunculata,* Moskau Michailowskoe, Massolaff 677, 8. 1904, R.P.K. 1919 (ex S).

35. CHLOROSPLENIUM STEMMATUM (Karst.) Karst., Not. Sällsk. Fauna Fl. Fenn. Förh. 13: 232. 1873.

≡ *Peziza stemmata* Karst., Fungi Fenn. Exs. No. 548. 1866; Not. Sällsk. Fauna Fl. Fenn. Förh. 10: 154. 1869 (!) (!!).

≡ *Ombrophila stemmata* (Karst.) Karst., Bidrag Kännedom Finlands Natur Folk 19: 94. 1871.

≡ *Chlorospleniella stemmata* (Karst.) Karst., Acta Soc. Fauna Fl. Fenn. 2: 141. 1885.

≡ *Coryne stemmata* (Karst.) Sacc., Syll. Fung. 8: 645. 1889.

≡ *Corynella stemmata* (Karst.) Boud., Hist. Class. Discom. d'Europe p. 99. 1907.

Notes: I have examined two isotypes and an authentic specimen of this species and find them all to be a *Mollisia.* That genus is desperately in need of monographic work and I choose not to make any new combinations in it.

Specimens Examined: FINLAND: Isotype of *Peziza stemmata,* Karsten, Fungi Fenniae Exs. No. 548, H, FH (=CUP 52704); Authentic specimen, ad *Betulam,* Fennia, Regio aboënsis [Aboae = Turku], Lill-Heikkilä [= Vähä-Heikkilä], P. A. Karsten, 15. X. 1861, H (=CUP 52632).

36. CHLOROSPLENIUM STRIISPORUM Ellis & Dearn. in Ellis & Everh., Proc. Acad. Nat. Sci. Philadelphia 47: 429. 1895 (!!).

≡ *Ascobolus striisporus* (Ellis & Dearn.) Seaver, N. Amer. Cup-Fungi (Opercul.) p. 90. 1928.

Notes: Examination of an isotype specimen of this species clearly shows that Seaver (1928) was correct in placing it in *Ascobolus.* Van Brummelen (1967) has synonymized this species with *A. foliicola* Berk. & Br., J. Linn. Soc., Bot. 11: 109. 1871. This appears to be the correct name for this fungus and those interested in a more complete synonymy should see van Brummelen (1967).

Specimen Examined: CANADA - ONTARIO: Isotype of *Chlorosplenium striisporum,* on decaying leaves, London, Ont., J. Dearness 2281, July '95, CUP-D 4528 (77-57).

37. CHLOROSPLENIUM SUBTORTUM Fr. ≡ *Chlorencoelia torta* (Schw.) Dixon, q.v.

38. CHLOROSPLENIUM TORTUM (Schw.) Sacc. ≡ *Chlorencoelia torta* (Schw.) Dixon, q.v.

39. CHLOROSPLENIUM VERSIFORME (Pers. per Pers. : Fr.) de Not. ≡ *Chlorencoelia versiformis* (Pers. per Pers. : Fr.) Dixon, q.v.

40. CHLOROSPLENIUM VIRESCENS (Tul. & Tul.) Cooke = *Claussenomyces atrovirens* (Pers. per Pers. : Fr.) Korf & Abawi; for complete synonymy see excluded species #6, above.

41. CHLOROSPLENIUM VIRIDULUM (Massee & Morg.) Dennis, Kew Bull. 17: 376. 1963.
≡ *Lachnum viridulum* Massee & Morg., J. Mycol. 8: 187. 1902 (!!).
≡ *Dasyscyphus chlorellus* Seaver (ut *Dasyscypha chlorella*), Mycologia 3: 63. 1911, non *D. viridulus* (Schrad. per Fr.) Sacc. 1889.
≡[*Dasyscyphus morgani* Massee in Dennis (ut *Dasyscypha*), Kew Bull. 17: 376. 1963, nomen nudum, pro synon.]
= ? *Trichopeziza viridula* Grelet, Rev. Mycol. (Paris) 18: 35. 1953.

Notes: Examination of the type and isotype speciens of this species shows that it is closely related to *Peziza caesio-lutea* Berk. & Br. as concluded by Dennis (1963). The gelatinized ectal excipulum composed of textura prismatica and granularly roughened tomentum hyphae seem to indicate that this belongs to the Trichoscyphelloideae or Hyaloscyphoideae. I choose not to designate a generic position for it until further work is completed. It seems possible that *P. caesio-lutea* (excluded species #10, above) and *L. viridulum* might constitute the nucleus for a new genus.

Specimens Examined: U.S.A. - OHIO: Holotype of *Lachnum viridulum* (ut *Dasyscypha morgani*), on *Quercus alba*, Preston, A. P. Morgan 44, 1898, K; Isotypes: IA-Morgan 44 (=CUP 51724), CUP-D 2738 (92-142), NY-Massee s.n. (=CUP 51726); IA-Morgan 285 (=CUP 51725); CUP-D 2128 (92-141).

SPECIES IMPERFECTLY KNOWN

The following species have all been referred to *Chlorosplenium* but are known to the writer only from description. In no case has the writer been able to locate type or authentic material for study and because of the limited nature of the descriptions a reliable generic disposition is impossible.

1. CHLOROSPLENIUM CHLOROPHANUM (Roussel ex de Not.) Boud., Hist. Class. Discom. d'Europe p. 110. 1907.
   - ≡ *Peziza chlorophana* Roussel ex de Not., Comment. Soc. Critt. Ital. 1: 385. 1864.
   - ≡ *Ciboria chlorophana* (Roussel ex de Not.) Sacc., Syll. Fung. 8: 206. 1889.

Notes: The description of this species by de Notaris (1864) was repeated by Saccardo (1889). De Notaris wrote that the species occurs "Su rami di *Thuja,*" indicating to me that this species might be a *Chloroscypha.*

2. CHLOROSPLENIUM FENNICUM (Karst.) Karst., Meddeland. Soc. Fauna Fl. Fenn. 9: 232. 1873.
   - ≡ *Peziza fennica* Karst., Not. Sällsk. Fauna Fl. Fenn. Förh. 10: 154. 1869.
   - ≡ *Ombrophila fennica* (Karst.) Karst., Bidrag Kännedom Finlands Natur Folk 19: 94. 1871.
   - ≡ *Chlorospleniella fennica* (Karst.) Karst., Acta Soc. Fauna Fl. Fenn. 2: 141. 1885.
   - ≡ *Coryne fennica* (Karst.) Sacc., Syll. Fung. 8: 645. 1889.

Notes: Karsten himself must have been rather uncertain of the taxonomic position of this species since he first placed it in *Peziza* and later on different occasions transferred it to three other genera. Until a specimen of this species can be located, and none was found in the Karsten Herbarium at Helsinki, it appears the species must remain a *nomen dubium.* Saccardo was the only other person to treat this species and his description was merely a repetition of that given by Karsten.

3. CHLOROSPLENIUM LUTEOVIRENS (Fr.) Sacc. (ut "luteo-virens"), Syll. Fung. 8: 320. 1889.
   - ≡ *Peziza luteovirens* Fr., Syst. Mycol. 2(1): 133. 1822.
   - ≡ *Helotium luteovirens* (Fr.) Fr., Summa Veg. Scand. p. 356. 1849.

Notes: A search of the Friesian Herbarium at the Institute of Systematic Botany at Uppsala by Dr. Lundqvist failed to locate any specimen of this species. I have examined a North American specimen from the Schweinitz Herbarium (PH), but the specimen on deposit there was so fragmentary that it was of no value in trying to reach any taxonomic conclusions. The original description of this species and those of Schweinitz (1832) and of Bommer & Rousseau (1891) are so scanty that it is impossible to state even to which genus this might belong. Hence, until the type or an authentic specimen can be located or a neotype designated, this species remains a *nomen dubium.*

4. CHLOROSPLENIUM TUBEROSUM Karst. & Har., Rev. Mycol. (Toulouse) 12: 170. 1890.

Notes: It is possible that Karsten had before him a specimen of *Whetzelinia* or *Botryotinia.* He wrote in the original description, "Apothecia e tubere communi erumpente, crasso (circa 2-3 mm), aerugino-atro, difformi enata, sessilia vel breviter stipitata. Cupulae concavae, obtuse marginatae, disco e cellulis filiformibus, simplicibus, raro ramosis, dilutissime ferrugineis (paraphysibus ?) composito." This species remains a *nomen dubium* since no specimen could be located in the Karsten Herbarium at Helsinki.

5. CHLOROSPLENIUM URBANIANUM Henn., Bot. Jahrb. Syst. 17: 525. 1893.

Notes: The type specimen of this species was apparently destroyed during World War II and the original description is too scanty to venture a taxonomic opinion.

6. CHLOROSPLENIUM VIRIDE (Schw.) Morgan, J. Mycol. 8: 185. 1902.
≡ *Cantharellus viridis* Schw., Trans. Amer. Philos. Soc. 4: 153. 1832.

Notes: Through the courtesy of Dr. Schuyler, the Schweinitz Herbarium has been examined thoroughly and he was unable to find any specimens deposited under this name. The personal notes of Elias J. Durand (on deposit, CUP) state that on Jan. 27, 1902, he examined a packet from the Schweinitz Herbarium marked *Cantharellus viridis* N.A. 301 and found the packet empty. The writer has examined a specimen collected by Morgan (ut *Cantharellus viridis,* Schw.) and found it to be unquestionably *Chlorociboria aeruginascens.* Morgan (1902) transferred *Cantharellus viridis* to *Chlorosplenium* and listed *Peziza aeruginascens* Nyl. in synonymy. Seaver (1951) considered the two species as synonyms of *Chlorociboria aeruginosa.* Schweinitz's name could provide an older epithet for *P. aeruginascens* if the type or authentic material could be located, but until such time the species is a *nomen dubium.*

Specimen Examined: U.S.A. - OHIO: (substrate unknown), Preston, A. P. & L. V. Morgan, Sept. 21, 1892, CUP-D 1231 (76-4).

(to be continued)

(References for Part I will appear in the next issue of MYCOTAXON at the close of Part II.)

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NOTES ON SPECIES OF *PARMOTREMA* (LICHENES: PARMELIACEAE) CONTAINING YELLOW PIGMENTS

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Summary

Chemistry, nomenclature, and distribution of 14 species of *Parmotrema* containing yellow pigments in the medulla are discussed. Two new species, *P. conjunctum* and *P. flavomedullosum*, are described and two new combinations, *P. lyngeanum* (Zahlbr.) Hale and *P. ultralucens* (Krog) Hale, are made.

Introduction

While the 14 species of *Parmotrema* with a yellow or yellow-orange medulla form a heterogeneous group, they are treated together here for practical purposes. The presence of these pigments is an important character in taxonomic keys. Full descriptions and synonymy of most of the species will be found in Hale's (1965) monograph of *Parmelia* subgenus *Amphigymnia*, now recognized as a distinct genus, *Parmotrema* (Hale, 1974), and will not be repeated here. The present notes are intended to update our knowledge of the species, especially their chemistry, which had not previously been studied with thin-layer chromatography. Two standard solvent systems were used: hexane-ether-formic acid and benzene-dioxane-acetic acid. The chemistry is based on testing of type materials unless otherwise noted.

List of Species

1. *Parmotrema affluens* (Hale) Hale, Phytol. 28: 334. 1974

Parmelia affluens Hale, Phytol. 22: 141. 1971.

Since publishing this species I identified the chemical constitutents more precisely as protocetraric and echinocarpic acids with several associated unknown compounds. The yellow color of the medulla, sometimes rather faint, is caused by entothein and unknown pigments. There is no satisfactory TLC separation for these pigments and while all the species treated in this paper (excepting *P. cornutum* and *P. sulphuratum*) appear to contain one or more pigments, chromatographic profiles show considerable variation and streaking. It is hoped that more satisfactory techniques will eventually resolve their identity.

Parmotrema affluens had previously been misidentified as *P. araucariarum* (Hale, 1971). It actually resembles *P. dilatatum* (Vainio) Hale, which has protocetraric and echinocarpic acids but lacks pigmentation. The species is known from South America and one locality in northern India. No nonsorediate parent species has been found.

2. *Parmotrema appendiculatum* (Fée) Hale, Phytol. 28: 334. 1974.

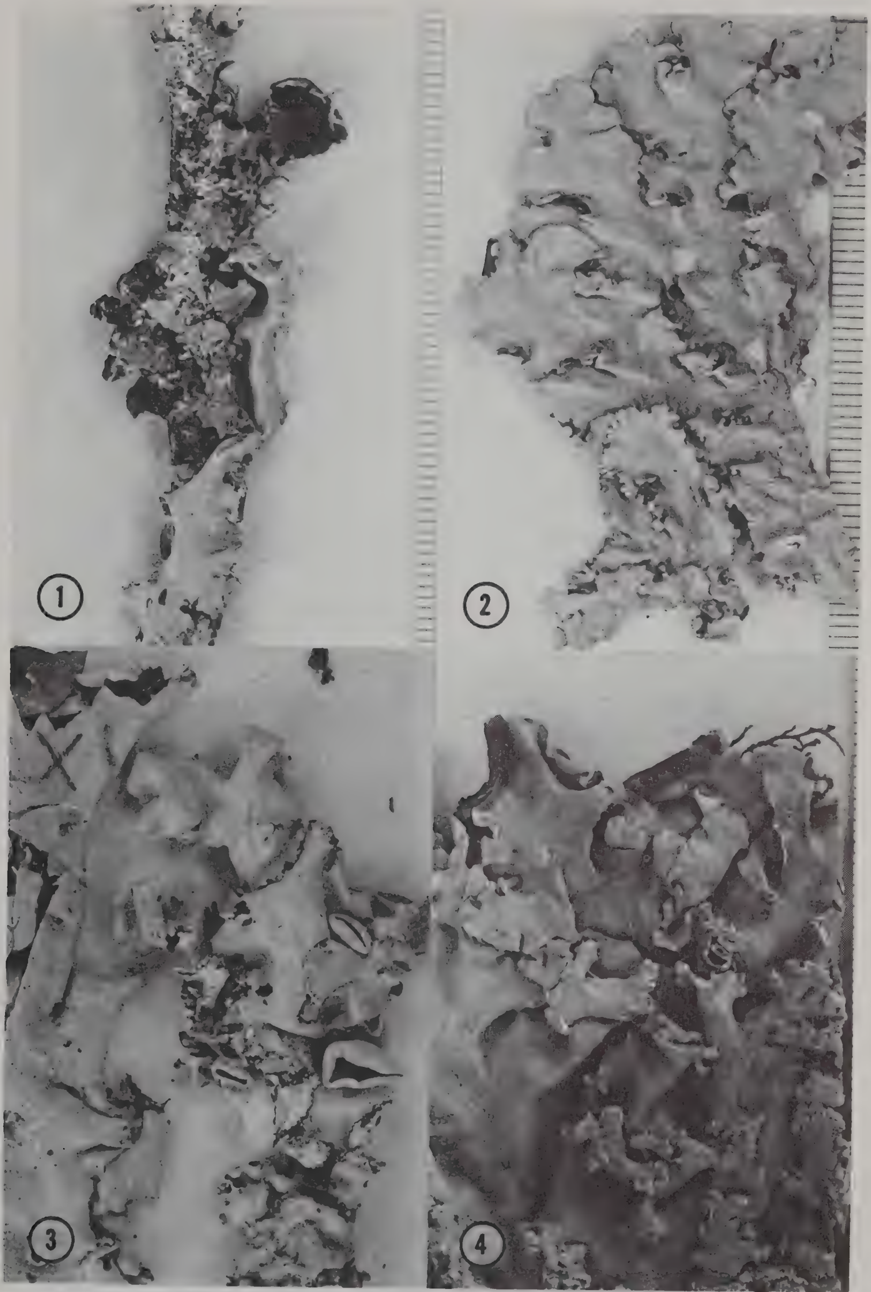
Parmelia appendiculata Fée, Essai Crypt. Ecorce Suppl. 118. 1837.

The chemical constitutents of this rare species (Figure 1) are atranorin, barbatic acid, and pigments including entothein. The medulla is clearly pigmented, however, only near apothecia and in the medulla of the amphithecium. Specimens from South America that I identified as this species (Hale, 1965, p. 278) contain protocetraric acid and must be referred to *P. cristatum*. As so delimited, *P. appendiculatum* is known only from the type locality on Bourbon.

3. *Parmotrema araucariarum* (Zahlbr.) Hale, Phytol. 28: 334. 1974.

Parmelia araucariarum Zahlbr. Denkschr. Akad. Wiss. Math. Naturw. Wien, 83: 179. 1909.

The chemistry of the type collection has been redetermined as atranorin, an unidentified fatty acid, and entothein and related unknown pigments, present in rather low amounts. Cilia may be very sparsely developed. Excepting the type, all specimens that I identified as this species



Figures 1-4. Species of *Parmotrema* with a yellow medulla: 1, *P. appendiculatum* (lectotype in G); 2, *P. conjunctum* (holotype in S); 3, *P. crocoides* (*Hale* 38832 in US); 4, *P. flavomedullosum* (holotype in US). Scale in mm.

(Hale, 1965, p. 238) (excluding *Grassi* 384 and 469, which are *P. conjunctum*) should now be called *P. affluens* (see above). As a result, *P. araucariarum* is known only from the type collection in São Paulo, Brazil.

4. *Parmotrema conjunctum* Hale, sp. nov.

Thallus laxe adnatus (Figure 2), usque ad 12 cm diametro, cinereo-albus, superne planus, nitidus, lobis 8-12 mm latis, apice rotundatis, margine sorediatis, soraliis distinctis, eciliatis; cortex superior 12-15µm crassus, stratum gonidiale 14-16µm crassum, medulla flava, 105-120µm crassa, cortex inferior 16-18µm crassus; subtus niger, modice rhizinosus, ambitu nudus atque castaneus, nitidus. Apothecia ignota.

Chemistry: Atranorin, gyrophoric acid, lichexanthone (in the medulla), and entothein and related pigments (TLC identical with that of *P. endosulphureum*).

Holotype: Rio Negro, Gran Chaco, Paraguay, *G.A. Malme*, 14 Sept. 1893 (S).

Additional specimens examined. Argentina. Salta: *Digilio-Grassi* 384, 469 (US).

This species superficially resembles both *P. affluens* and *P. araucariarum* because of the yellowish medulla, but the soralia are strictly marginal and more discrete than in either of those species. The occurrence of lichexanthone in the medulla is unusual; only *P. ultralucens* (Krog) Hale, comb. nov. (basionym: *Parmelia ultralucens* Krog, Bryol. 77: 253. 1974) and *P. diffractaicum* (Essl.) Hale (Esslinger, in litt.) also contain this normally cortical substance in the medulla. It is otherwise close in chemistry to *P. endosulphureum*. This species has been collected in temperate Paraguay and Argentina and should also occur in Uruguay.

5. *Parmotrema cornutum* (Lynge) Hale, Phytol. 28: 335. 1974.

Parmelia cornuta Lynge, Ark. Bot. 13 (13): 76. 1914.

The medulla of this species is bright lemon yellow as in other species with vulpinic acid. It is morphologically close to *P. cristatum* (see below) except for chemistry. This rare lichen is still known only from the type collection.

6. *Parmotrema cristatum* (Nyl.) Hale, Phytol. 28: 335. 1974.

Parmelia cristata Nyl. Flora 52: 291. 1869.

Material of this South American species had been identified as *P. appendiculatum* (Hale, 1965, p. 278) because of the yellow medulla and conspicuously ciliate-laciniate apothecia. Chemically the two differ, however, *P. cristatum* producing atranorin, protocetraric acid, entothein, and unknown pigments. *Parmotrema cristatum* is a rare species known from only three collections.

Specimens examined. Venezuela. Barinas: *Steyermark* 102058 (US). Brazil. Tarapoto, Amazon, *Spruce* 118 (BM).

7. *Parmotrema crocoides* (Hale) Hale, Phytol. 28: 335. 1974.

Parmelia crocoides Hale, Contr. U.S. Nat. Herb. 36: 244. 1965.

I recently re-examined the type of *P. crocoides* and found that it contained gyrophoric acid and dull reddish pigments that could not be conclusively identified with entothein or any associated pigments. The presence of gyrophoric acid, however, immediately related it to a series of nonsorediate, nonisidiate specimens from Mexico and Central America (for example, *Wirth* 80 and *Cain* 27603, previously identified as *Parmelia myelochroa*), which have a distinct yellow to yellow-orange medulla. These specimens are indistinguishable externally with a shiny cortex, abundant pycnidia, and distinctive crenate margins on crowded central lobes (Figure 3). TLC profiles varied considerably in minor constituents. Most seemed to have entothein in addition to other unidentified spots not present, for example, in *P. endosulphureum*. It is possible that pigments in the *P. crocoides* type have been altered by preservation or other factors. In any event, it is probably better for the present to include all fertile species containing gyrophoric acid and pigments under the name *P. crocoides* until new collections prove whether or not the reddish color is a natural phenomenon.

One other collection previously identified as *Parmelia myelochroa (Mexia* 5239) and *Steyermark* 101845 differ in lacking gyrophoric acid although the yellow pigmentation is similar to that of specimens containing gyrophoric acid. I am provisionally considering these to represent an acid-deficient population.

Specimens examined. Mexico. Colima: *Wirth* 80 (US); Nayarit: *Cain* 27603 (TRT, US). Costa Rica. San José: *Standley & Valerio* 43405a (US). Panama. Chiriquí: *Hale* 38832, (US). Venezuela. Apure: *Standley* 101845 (US). Brazil. Minas Gerais: *Mexia* 5239 (US).

8. *Parmotrema endosulphureum* (Hillm.) Hale, Phytol. 28: 336. 1974.

Parmelia tinctorum var. *endosulphurea* Hillm. Repert. Sp. Nov. Fedde, 48: 8. 1940.

P. endosulphurea (Hillm.) Hale, Contr. U.S. Nat. Herb. 36: 251. 1965.

The chemistry of this pantropical species has been redetermined as atranorin, gyrophoric acid, and entothein and associated compounds. As the only densely isidiate species with a yellow medulla it could be mistaken for *P. tinctorum* (Nyl.) Hale if medullary color were not checked. It is by far most common in the Caribbean region.

9. *Parmotrema flavomedullosum* Hale, sp. nov.

Thallus laxe adnatus (Figure 4), expansus, usque ad 15 cm latus, cinereo-albus, nitidus, lobis ca 1 cm latis, apice rotundatis, planis vel aetate rugosis, cortice marginem versus friato, demum sorediascente, sorediis crassis, eciliatis vel raro sparse ciliatis; cortex superior 12-15µm crassus, stratum gonidiale 14-16µm crassum, medulla flava, 100-120µm crassa, cortex inferior 12µm crassus; subtus niger, modice rhizinosus, ambitu late nudus, castaneus. Apothecia ignota.

Chemistry: Atranorin, gyrophoric acid, entothein, and unidentified pigments.

Holotype: On rocks, Colonia Santa Catarina, Santa Catarina, Brazil, *Reitz & Klein* 15051, 9 August 1963 (US).

Additional specimens examined. Venezuela. Zulia: *Steyermark* 105633-A (US). Brazil. Minas Gerais: *Höhne* (US, W); Paraná: *Montes* 10137 pp. (MVM); Santa Catarina: *Reitz & Klein* 15507 (US). Paraguay. Asunción: *Malme* 1585 (BM, S). Argentina. Córdoba: *Stuckert* 20970 (US).

This species belongs to the *P. endosulphureum*-*P. conjunctum* complex. It has coarse, irregular, submarginal soralia and without careful examination might be misidentified as *P. affluens*, which reacts P+ red, C- (protocetraric acid). *Parmotrema conjunctum* has strictly marginal soralia and lichexanthone in the medulla in addition to gyrophoric acid.

10. *Parmotrema lyngeanum* (Zahlbr.) Hale, comb. nov.

Parmelia lyngeana Zahlbr. Cat. Lich. Univ. 6: 243. 1929.

Parmelia merrillii Lynge, Ark. Bot. 13(13): 78. 1914 (not *P. merrillii* Vainio ex anno 1909).

P. cornuta var. *crocea* Lynge, Ark. Bot. 13(13): 78. 1914.

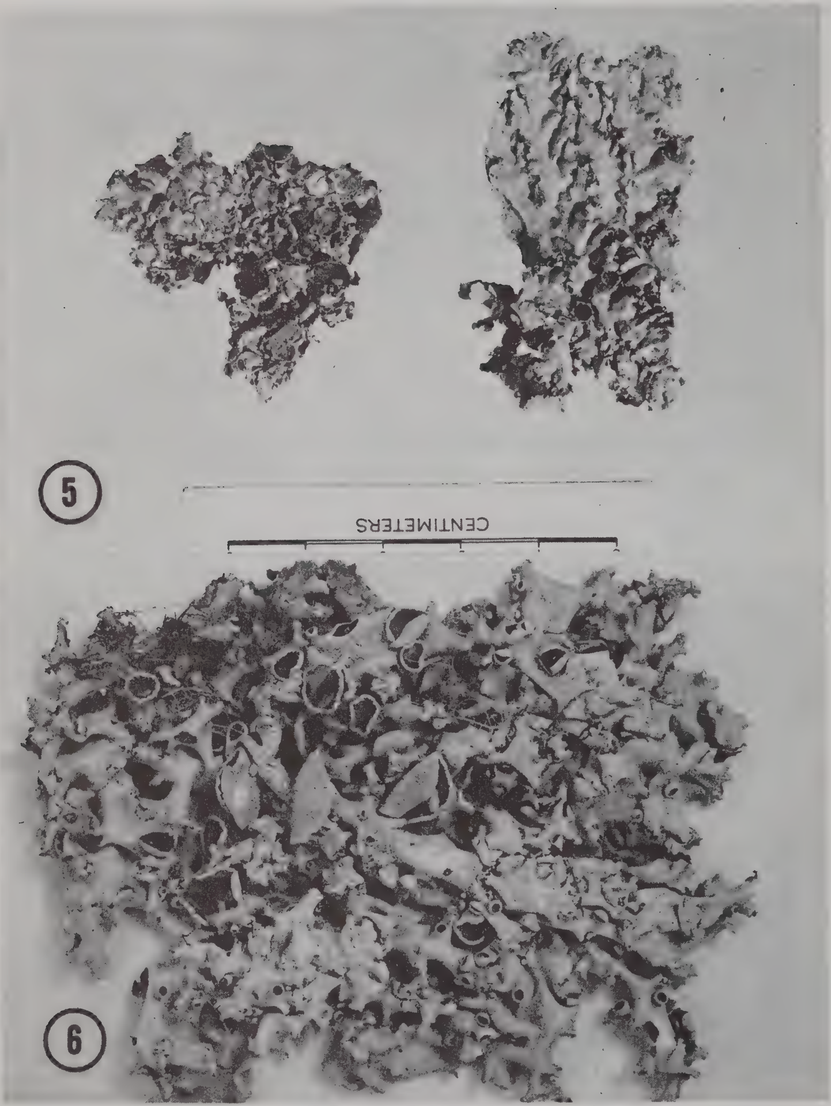
P. crocea (Lynge) Gyelnik, Repert. Sp. No. Fedde 29: 287. 1931 (not *P. crocea* (Ach.) Spreng. ex anno 1827).

This species (Figure 5) is externally very similar to *P. cornutum* but contains atranorin, apparently entothein, and in the lower part of the medulla the red anthraquinone rhodophyscin. TLC profiles of the types of *Parmelia merrillii* and *P. cornuta* var. *crocea* are identical. No further collections of this Brazilian species have been made. I had previously synonymized this species under *Parmelia appendiculata* (Hale, 1965, p. 278), which does not occur in the New World.

11. *Parmotrema myelochroum* (Hale) Hale, Phytol. 28: 337. 1974.

Parmelia myelochroa Hale, Contr. U.S. Nat. Herb. 36: 256. 1965.

No definite lichen substances were reported in the original description of this species (Figure 6), but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Figures 5, 6. Species of *Parmotrema* with a yellow medulla: 5, *P. lyngeanum* (lectotype in S); 6, *P. myelochroum* (holotype in US).

Dr. C. F. Culberson, using TLC, identified atranorin, barbatic acid, obtusatic acid (in high concentration), entothein, and unidentified pigments. Re-examination of specimens identified as *P. myelochroa* (Hale, 1965, p. 256), where available, showed that the species occurs only in one locality in Mexico and that those from other countries should be identified as *Parmotrema crocoides*.

12. *Parmotrema permutatum* (Stirton) Hale, Phytol. 28: 328. 1974.

Parmelia permutata Stirton, Scot. Nat. 4: 252. 1877-78.

This species differs from others in this broad group in that the pigment occurs only in the lower half of the medulla. It has conspicuous cilia and distinct marginal soralia. It is pantropical on rocks and trees in dry areas, but we have too few specimens to judge the full range of morphological and chemical variation.

13. *Parmotrema subcoloratum* (Hale) Hale, Phytol. 28: 339. 1974.

Parmelia subcolorata Hale, Contr. U.S. Nat. Herb. 36: 340. 1965.

This is the only species with a yellow medulla treated in this paper that occurs exclusively in Africa. Krog (in litt.) has identified gyrophoric acid in the medulla along with entothein. It differs significantly from other members of the group in having perforate apothecia and small spores as well as coarse cilia and strong white maculae.

14. *Parmotrema sulphuratum* (Nees & Flot.) Hale, Phytol. 28: 339. 1974.

Parmelia sulphurata Nees & Flot. Linnaea 9: 501. 1835.

This species has a bright yellow medulla (vulpinic acid) and a TLC profile identical to that of *P. cornutum*. The cortex is often cracked, revealing the pigment. Marginal cilia and sparse isidia are always present. The species is pantropical at lower elevations and has often been confused with *P. endosulphureum*, which has dense isidia, lacks cilia, and contains gyrophoric acid and entothein.

Interrelationships of the Yellow-pigmented Species

The unifying elements in this artifical group are the yellow to yellow-orange pigmented medulla, broad rotund lobes, and imperforate apothecia with large, thick-walled spores (except for *P. subcoloratum* which has perforate apothecia and small spores). Beyond this the species are chemically diverse and belong to several different phylogenetic lines. The following notes are provided to help in understanding the possible evolution of these species.

The most obviously natural group centers around *P. endosulphureum*, an eciliate, isidiate pantropical species. Other vegetative morphs, all containing gyrophoric acid, include sorediate *P. conjunctum* and *P. flavomedullosum*, the latter two restricted to temperate southern South America. The presumptive nonisidiate, nonsorediate parent is (or at least would be very similar to) entothein-containing *P. crocoides*, which occurs chiefly in Central America. *Parmotrema myelochroum* may have evolved within this group as a new chemical population (barbatic acid).

The cornute species, *P. appendiculatum*, *P. cornutum*, *P. cristatum*, and *P. lyngeanum*, appear to have a common origin but have diverged considerably in chemistry. They lack any obvious vegetative morphs, unless one considers *P. sulphuratum* to be related to *P. cornutum* because of the similar and unusual chemistry, vulpinic acid. They are all so rarely collected, however, that we are still not certain of the geographic distribution and total range of morphological and chemical variation.

Parmotrema affluens lacks cilia and falls close to unpigmented *P. dilatatum* (Vainio) Hale in chemistry, sharing protocetraric and echinocarpic acids. It has no obvious parent morph. The position of *P. araucariarum*, a morphologically similar species, is unclear at this time, but it is probably near *P. affluens*.

Pantropical *P. permutatum* is externally similar to *P. sancti-angelii*, which has gyrophoric acid but no yellow pigments. Both species, if correctly interpreted, would then fall within the large series of gyrophoric acid-containing ciliate species, known chiefly from Africa, whose relationships have not yet been worked out.

Finally, *P. subcoloratum* represents an isolated African species apparently unrelated to any other species containing yellow pigments.

Key to Species of Parmotrema *Containing Yellow Pigments*

1. Thallus lacking soredia and isidia.
    2. Cilia lacking.
        3. Gyrophoric acid present (rarely lacking). *P. crocoides*
        3. Barbatic acid present. *P. myelochroum*
    2. Cilia present along lobe margins.
        4. Apothecia without marginal laciniae. *P. subcoloratum*
        4. Apothecia lobulate or laciniate.
            5. Vulpinic acid present. *P. cornutum*
            5. Entothein or unidentified yellow pigments present.
                6. Barbatic acid present. *P. appendiculatum*
                6. Barbatic acid lacking.
                    7. Medulla P+ red. *P. cristatum*
                    7. Medulla P−. *P. lyngeanum*
1. Thallus isidiate or sorediate.
    8. Thallus isidiate.
        9. Cilia present. *P. sulphuratum*
        9. Cilia absent. *P. endosulphureum*

8. Thallus sorediate.
    - 10. Cilia present. *P. permutatum*
    - 10. Cilia absent (very short and sparse in *P. araucariarum*).
        - 11. Medulla P+ red (protocetraric acid). *P. affluens*
        - 11. Medulla P-.
            - 12. Gyrophoric acid lacking. *P. araucariarum*
            - 12. Gyrophoric acid present.
                - 13. Soredia marginal; lichexanthone present. *P. conjunctum*
                - 13. Soredia submarginal to laminal, coarse; lichexanthone absent. *P. flavomedullosum*

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NEW HYPHOMYCETES FROM GUADELOUPE, F.W.I. ALBOSYNNEMA FILICOLA, TETRACRIUM MUSICOLA, AND THOZETELLOPSIS CALICIOIDES

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While collecting discomycetes on the Island of Guadeloupe in the French West Indies as part of the Flora Neotropica project the author encountered a number of unusual synnematous and sporodochial hyphomycetes growing on decaying vegetable debris. Three of these were sufficiently distinctive to be unambiguously determined as new species and are described below.

1: Tetracrium musicola Sherwood sp. nov. (Fig. 1: a, b)

Conidia in sporodochiis minutis hyalinis superficialibus elata. Conidiophora ad unam cellulam tumidam 5-6 µm latam et subaeque longam redacta. Conidia hyalina, ramosa, 35-45 µm longa, 5-8-brachiata, brachiis 2-2.5 µm latis multiseptatis ad septa constrictis.

Hab. In foliis putrescentibus *Musae paradisicae* L.

Holotypus: D. Pfister, S. Carpenter & M. Sherwood *#931*, above town of Village along Crête de Village, at ±630 m, Guadeloupe, January 5, 1974. (FH).

Sporodochia minute, pulvinate, completely hyaline, consisting of a small cushion of hyaline, isodiametric cells and an outer, spore-bearing layer. Conidia are borne on specialized, thin-walled, inflated cells which rupture at maturity. Each of these cells bears a single, slightly enlarged basal cell which bears 2 or 3 primary branches. The primary branches may be unbranched or once or twice branched to form the arms of the conidium. The arms (5-8 in number) are 2.0 µm broad and the total length of the conidium (excluding the ruptured cell) is 35-45 µm.

G. W. Martin (1948) described a similar fungus (*T. incarnatum*) on *Opuntia* from the Galopagos Islands. *T. musicola* differs from *T. incarnatum* in the apparent lack of differentiated conidiophores and the narrower conidia. The other species of *Tetracrium* all have much larger conidia.

2: Albosynnema filicola Sherwood sp. nov. (Fig. 1: c, d)

Synnemata ad 2 mm longa, 0.1 mm lata, stipite ex hyphis tenuibus hyalinis composito, capite fructificante 150 x 400 µm, elongato et subacuto. Conidia in apicibus hypharum non specialum elata, obscure viride-brunnea, 4-cellulata, pyriformia, 26-32 x 10-11 µm.

Hab: In petiolis mortuis Cyatheae arboreae (L.) Sm.

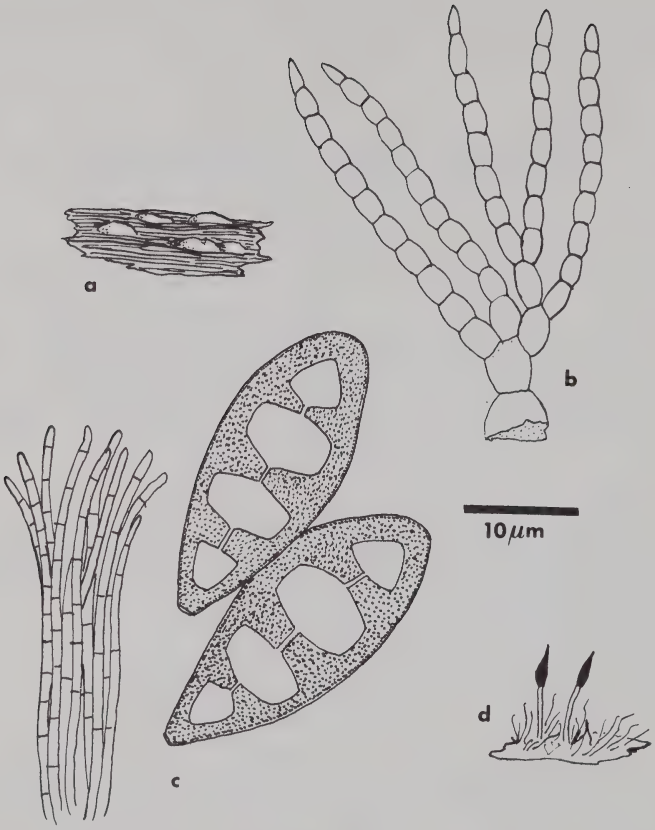

Figure 1: a. *Tetracrium musicola,* habit sketch. b. *Ibid.,* conidium. c. *Albosynnema filicola,* conidiophores and conidia. d. *Ibid.,* habit sketch.

Holotypus: D. Pfister, S. Carpenter & M. Sherwood *#753*, La Soufriére, Forêt des Bains Jaunes, ±1050-1155 m, Guadeloupe, January 3, 1974 (FH).

Synnemata up to 2.0 mm long, 0.1mm broad, composed of slender hyaline hyphae; fruiting head elongate, 150 x 400 μm, greenish-black, somewhat pointed apically. Conidia dark greenish brown, 4-celled, distoseptate, pyriform, 26-32 x 10-11 μm, borne on the tips of unspecialized hyphae.

The original description (Morris, 1967) of the genus *Albosynnema* does not illustrate spores with exceptionally thick walls; there is, however, no genus that would better accomodate the present fungus. The lack of specialized structures at the apices of the conidiophores and the slightly truncate bases of the conidia suggest that the conidia are blastic. The very long synnemata are possibly an adaptation to growth on a substrate covered with a dense felt of thorns and matted hairs. The fungus appears to be gloeosporous as the spores are not easily dispersed in crush mounts.

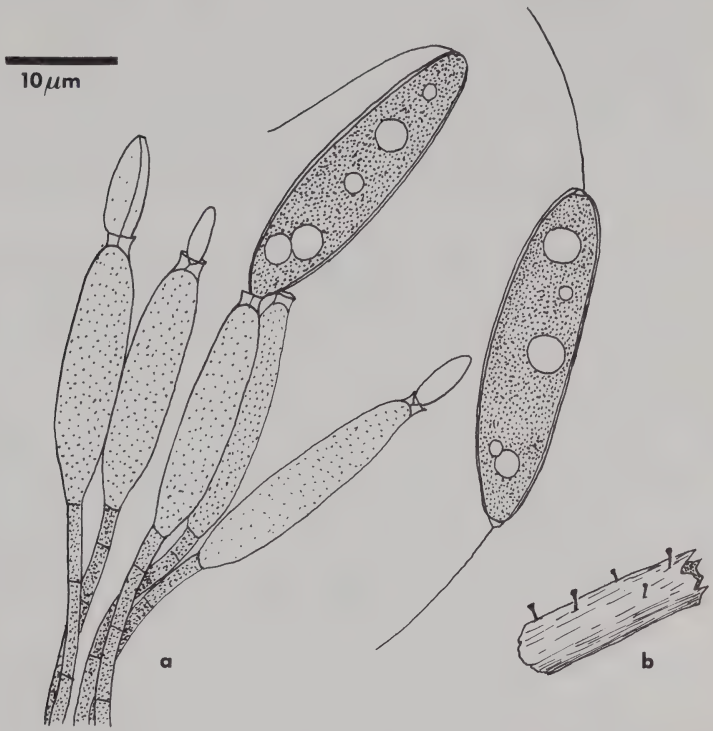

Figure 2: a. *Thozetellopsis calicioides*. Conidiophores and conidia. b. *Ibid.*, habit sketch.

3: *Thozetellopsis calicioides* Sherwood n. sp. (Fig. 2: a, b)

Synnemata obscure brunnea, 500 x 100 m, capite ad 250 µm latitudine accrescente. Stipes tenax, ex hyphis dense aggregatis 1.5 µm diam compositus. Conidia in phialidibus brunneis 20-22 x3.5-4.0 µm elata, 25-30 x 6-8 µm, unicellularia, brunnea, guttulata, setam hyalinum 10-15 µm longam in utraque extremitate gerentia.

Hab. In ramunculis corticatis specie indeterminatis.

Holotypus: D. Pfister, S. Carpenter & M. Sherwood *#987*. Grand Étang above Bananier, 400-416m, Guadeloupe, January 6, 1974 (FH).

Synnemata dark brown, 500x100 µm, with an abruptly enlarged head 250 µm across, growing on small corticate dead twigs. Stalk tough, composed of tightly packed parallel brown hyphae 1.5 µm in diameter. Sterile elements are absent from the head, which is composed of large cylindrical phialides 20-22 x 3.5-4.0 µm, with prominent collarettes. Conidia brown, 25-30 x 6-8 µm, with a hyaline seta 10-15 µm long at each end, the contents rather oily.

The genus *Thozetellopsis* Agnihothrudu (1958) is typified by a fungus rather different from the one here described. The original description states that it is sporodochial but the illustration suggests that it is synnematous. There are sterile hairs in the head and the conidia are hyaline. Many fungi imperfect (including coelomycetes) have allantoid setose phialospores, and an ontogenetic system of classification might well group these together. I do not think it necessary to erect a new genus for *T. calicioides* although the lack of sterile elements, and pigmented conidia, would be considered by some authors to be good generic characters. It is also close to *Menisporiopsis*.

Acknowledgements: The author wishes to thank R. P. Korf (CUP) and D. H. Pfister (FH) for assistance in preparing the manuscript, and W. Dress for preparing the Latin diagnoses. The study was supported in part by National Science Foundation Grant GB-36162 to D. H. Pfister.

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MYCOTAXON

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CAPNOBOTRYS DINGLEYAE N.SP.

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A species of sooty moulds found in New Zealand in 1963 on *Dacrydium cupressinum*, *Phyllocladus trichomanoides*, and *Podocarpus spicatus* is represented in DAOM by nine collections. According to collections preserved in Herb. K and Herb. IMI the same species occurs in England, Ireland and perhaps Scotland on *Taxus baccata* and possibly other coniferous hosts. Because the *Capnobotrys* state is more conspicuous and diagnostic than the accompanying *Capnophialophora* phialidic state the fungus is described in that form genus as *Capnobotrys dingleyae*.

Capnobotrys dingleyae sp. nov.

Subiculum variabile, olivaceo-brunneum vel atrobrunneum vel atrum, planum vel plerumque irregulariter incrassatum, 3-20mm crass., aliquando pustulis hemisphaericis 1-5mm lat., frequenter continuum, diffusum et truncos per pedes paucos tectans.

Mycelium superficiale, ex hyphis ramosis, subulatis, septatis, moniliformibus, pallide brunneis vel atrobrunneis, primo verrucosis dein laevibus vel paulo verrucosis, anastomosantibus, cellulis basalibus plerumque latioribus quam longis, ad 27µ lat., cellulis terminalibus angustioribus, 7-9µ lat., compositum.

Conidiophora hyphas simulantia sed apicem versus fertilia, 140-265µ long. Sympodioconidia 1-4 successive et in cellula terminalia conidiophorarum et in sympodula producta. Sympodulae 6.3-9.0µ orientes frequenter unilateraliter in cellulis 1-3 subterminalibus conidiophorarum, sessiles vel 1-3 in stipite breve (aseptata vel 1-septata), subglobosae, verrucosae.

Sympodioconidia pallide brunnea vel atrobrunnea, verrucosa, ovoidea vel late ellipsoidea vel obclavata, continua vel ad 6-septata, plerumque 2-3-septata, interdum 4-, raro 5- vel 6-septata, ad septas parum vel vix constricta, recta, sicca et facile secedentia. Sympodioconidia 10-11.7 X 7.2-8.0µ (0-septata), 10.5-20.0 X 8.6-11.0µ (1-sept.), 16-24(27) X 9.0-12.6µ (2-sept.), 23.5-33.5

X 10.8-12.6μ (3-sept.), 30.5-36 X 10.8-12.6μ (4-sept.), 42-45 X 12.6μ (duo tantum vidi 5-septata), 50 X 13μ (unum tantum vidi 6-septata).

Phialides (status *Capnophialophora*) apicem versus hypharum, singulares vel 2-4 botryosae, subsphaericae, pallide brunneae vel brunneae, parum asperatae vel verrucosae, 5.0-5.5μ lat., collum singulum (raro duo) cupulatum vel infundibuliforme, 3.2-3.6μ lat., 3.6μ profund., distaliter ferentes. Phialides frequenter in conidiis germinantibus productae. Phialospora sparsa, late ellipsoidea, hyalina, ca. 1.5 X 1.0μ.

Poroconidia non vidi.

Habitat in truncis vivis (raro emortuis) *Podocarpi spicati*, *Phyllocladi trichomanoidis*, *Dacrydii cupressini* in Nova Zelandia et *Taxi baccatae* in Anglia, Hibernia et ? Scotia.

Typus: in truncis vivis *Podocarpi spicati*, Nova Zelandia, "Banks Peninsula", 13.V.1963, PDD 21096 (DAOM 106368).

Dr. B. Boivin kindly corrected the Latin diagnosis. I am grateful to Drs. R.W.G. Dennis and M.B. Ellis for permission to examine collections in their keeping.

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A NEW *PHANEROCHAETE* WITH A *CHRYSOSPORIUM* IMPERFECT STATE

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SUMMARY

A new species is proposed in the genus *Phanerochaete* for a wood decaying fungus that is extremely important in the destruction of wood chips in storage. The names *Chrysosporium pruinosum*, *C. lignorum*, *Sporotrichum pruinosum*, and *S. pulverulentum* have all been applied to this species in its imperfect state. Complete descriptions of basidiocarps and cultures are presented and the use of the species in wood decay studies is discussed.

While collecting wood-rotting fungi in the Sonoran Desert, Arizona, in 1971, the senior author found an undescribed species of *Phanerochaete*. This species, which has a *Chrysosporium* imperfect state in culture, was represented at that time by this single Arizona collection. However, other specimens have since been encountered from New York and Maryland.

Earlier, a fungus identified as *Sporotrichum* sp. had been isolated from test wood chip storage piles in Georgia (Lindgren and Eslyn 1961) and Maine (Eslyn 1967). To conform to Carmichael's concept (1962), it was re-identified as *Chrysosporium* sp. When some of these isolates developed basidiocarps in culture they were sent to Dr. H. McKay, of the Forest Disease Laboratory, Laurel, Md. After examining the basidiocarps she designated the species "*Peniophora* G."

Comparisons of basidiocarps of the undescribed *Phanerochaete* species and those produced in culture by "*Peniophora* G" isolates showed them to be conspecific. In addition, the cultures derived from germinating spore prints of the *Phanerochaete* basidiocarps were almost identical in every way to the "*Peniophora* G" (*Chrysosporium* sp.) isolates from decay. The asexual state was identified as *Chrysosporium pruinosum* (Gilman et Abbott) Carmichael and this determination was subsequently confirmed by Dr. J. W. Carmichael, University of Alberta, Alberta, Canada.

Comparison of our cultures with Nilsson's wood chip pile isolate, which was first identified as *C. pruinosum* (Nilsson 1965) and later as *C. lignorum* Bergman et Nilsson (1966) *nomen nudum*, and Shields' (1969) isolate of *Ptychogaster* sp. from wood chips, showed all to be conspecific. Nilsson (Shields 1969) also considered his isolate to be identical to Shields' isolate as did Smith and Ofosu-Asiedu (1972), who noted that both isolates were probably *C. pruinosum*. Hofsten and Hofsten (1973) indicated that the Nilsson isolate is conspecific with *Sporotrichum pulverulentum* Novobranova.

In addition, Shields (1969) and Bergman and Nilsson (1971) believed their isolates to be the imperfect state of a basidiomycete, Shields indicating *Hyphodontia* and *Peniophora* as possible placements. The perfect state, however, has not been precisely identified to date. The present study has revealed the fungus to be a new species of *Phanerochaete* which is described herein.

Phanerochaete chrysosporium Burds., *sp. nov.* FIGS.1-12

Basidiocarpis late effusis, pallidoluteis vel luteobrunneis. Hyphis subiculis absque fibulatis. Cystidiis ab oriundis subhymenio aut subiculis, 60-150(-250) x 6.5-9 µm, cylindraceis, tenuibis parietibus, laevibus, obtusis apicibus. Basidiis 22-35 x 5-6 µm. Basidiosporis (5.5-) 6-7.5 (-9) x 3-4 µm, depressis ovoideis.

HOLOTYPE--U.S.A., Arizona: HHB 6251, on dead wood of *Platanus wrightii* S. Wats. (Arizona sycamore), Guadalupe Canyon, Peloncillo Mts., Cochise County, August 25, 1971 (CFMR). Isotype in BPI and ARIZ.

CON.STAT. --*Chrysosporium pruinosum* (Gilman et Abbott) Carmichael, Can. J. Bot. 40: 1166. 1962.

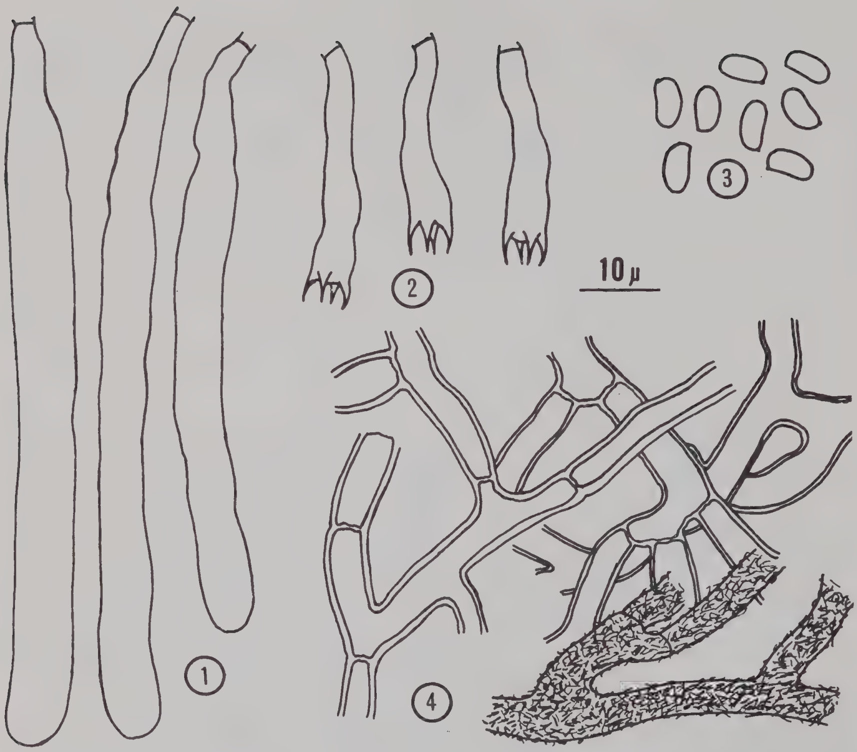
≡ *Sporotrichum pruinosum* Gilman et Abbott, Iowa State Coll. J. Sci. 1: 306. 1927.

= *Chrysosporium lignorum* Bergman et Nilsson (*nom. nud.*), Dept. Forest Prod., Roy. Coll. Forest., Stockholm, Res. Notes No. 53, p. 28. 1966.

=(?) *Sporotrichum pulverulentum* Novobranova, Akad. Nauk U.S.S.R., Botan. Inst. Nov. Sist. Niz. Rastenii 9: 180. 1972.

Basidiocarps broadly effused, (indeterminate), membranous, moist when fresh, yellowish-white (3A2)[1/] to light brown (5D5), up to 0.25 mm thick, loosely attached or separable in small pieces, smooth, continuous, not cracking; *margin* rather abrupt or up to 2 mm broad, sterile, very thin, powdery or finely granular, irregular in outline, white, non-rhizomorphic; *subiculum* byssoid, white. Hyphal system monomitic; *subiculum* a textura intricata, hyphae (Fig. 4) (3.5-)4.5-6(-7) µm diam, hyaline, thin walled or with walls up to 1 µm thick, lacking clamps, branched at nearly right angles, smooth near substrate to heavily encrusted with large hyaline crystals near subhymenium, sometimes with oval to spherical chlamydospore-like thick walled cells near substrate; *subhymenium* up to 75 µm thick, a compact textura intricata-porrecta, hyphae 2.5-4 µm diam, thin walled or with slight wall thickening, somewhat agglutinated; *hymenium* composed of cystidia (Fig. 1) and basidia (Fig. 2); *cystidia* (Fig. 1) arising at various levels of the subhymenium and subiculum, 60-150 (-250) x 6.5-9 µm, cylindrical, thin walled or with slight wall thickening, hyaline, smooth, obtuse at apex, septate only at base, lacking clamps, protruding up to 70 µm; *basidia* (Fig. 2) 22-35 x 5-6 µm, clavate, hyaline, thin walled, septate at base, lacking clamps, 4-sterigmate, sterigmata 4-5 µm long; *basidiospores* (Fig. 3) (5.5-) 6-7.5(-9) x 3-4 µm, depressed ovoid, hyaline, thin walled, smooth, not reacting with Melzer's reagent.

[1/] Color notations are those of Kornerup and Wanscher (1967), indicating plate number, vertical column, and horizontal column, respectively.



Figs. 1-4. Zeiss drawing tube drawings of microscopic characters of *Phanerochaete chrysosporium*, HHB 6251. 1. cystidia. 2. basidia. 3. basidiospores. 4. subicular hyphae.

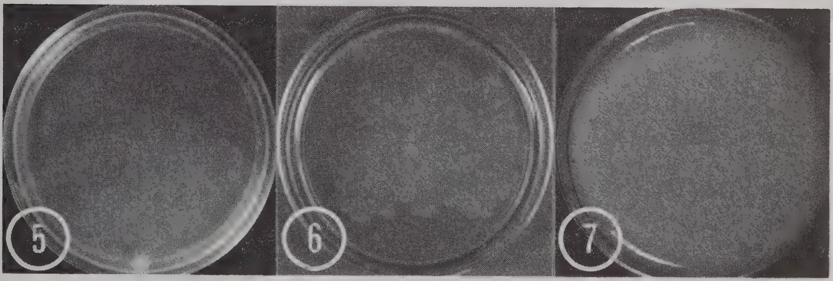
Etymology: from its *Chrysosporium* imperfect state.

Additional Specimens Examined: U.S.A., New York - MJL 98, on dead wood of *Ulmus americana* L., Monroe County (?); Maryland-104297, on dead wood of *Liriodendron tulipifera* L., Montgomery County. Both in CFMR.

Remarks: *Phanerochaete chrysosporium* basidiocarps are distinguished by their long, broad, cylindrical, smooth cystidia and complete lack of clamp connections. They are similar to *P. arizonica* Burds. et Gilbertson, which possesses much smaller cystidia arising in the subhymenium only and to *P. cremea* (Bres.) Parm. which also possesses smaller cystidia that are thick walled and usually encrusted. Neither of these is known to possess a *Chrysosporium* imperfect state.

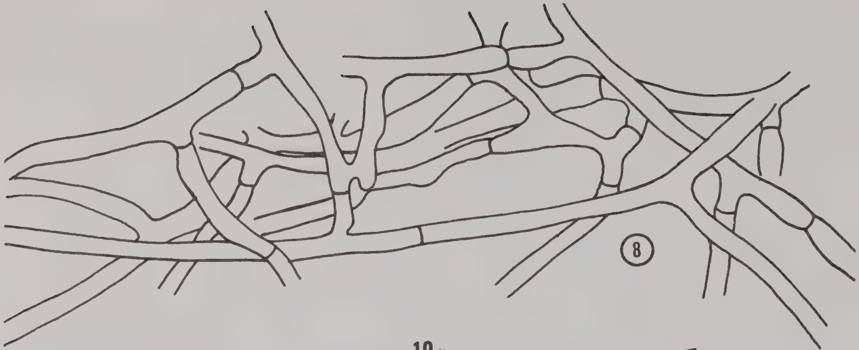
DESCRIPTION OF CULTURES

Growth Characters: Radial growth on 1.5% Difco Bacto Malt Extract Agar 45-60 mm in three days at 25C; mat (Fig. 5) very thin, white, appressed radiating, some isolates with granular surface 1-2 cm behind the advancing margin, others with granular surface after margin reaches edge of plate, granular aspect spreading from inoculum until entire plate is covered; agar bleached below inoculum and often over whole plate; some isolates producing cream-colored, effused hymenial surface, usually in 18-28 days, forming all structures typical of fruiting in nature; other isolates never fruit. On gallic acid agar (Davidson, et al. 1938) growth 24-30 mm diam/week, mat thin-woolly, margin irregular, agar not stained (Fig. 6); on tannic acid agar (Davidson, et al. 1938) no growth or staining of agar (Fig. 7); tests with syringaldazine and gum guaiac (Harkin and Obst 1973) negative, indicating lack of laccase, peroxidase and tyrosinase.



Figs.5-7. Cultures of *Phanerochaete chrysosporium* grown at 25C, HHB 6251. 5. on malt agar after three days growth. 6. on gallic acid agar after one week. 7. on tannic acid agar after one week.

Microscopic Characters: Hyphae of margin hyaline, thin walled, 3.5-7 μm diam, smooth, infrequently branched, densely stained in phloxine, first septum usually occurring more than 1 mm from tip, clamps lacking.



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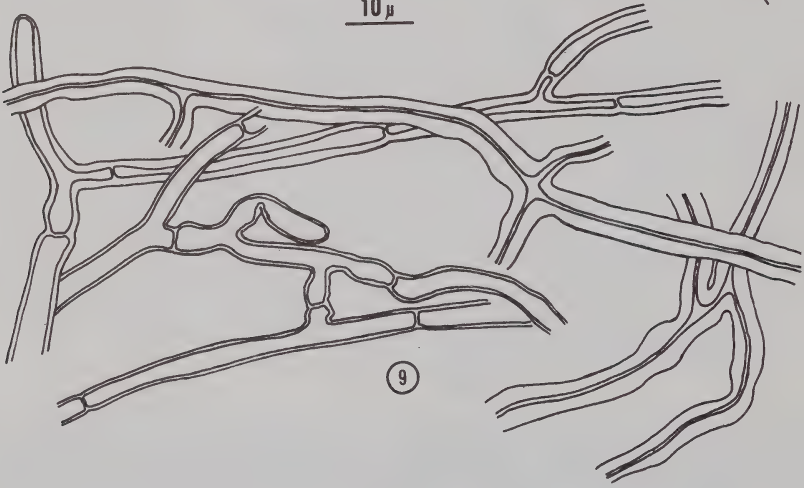

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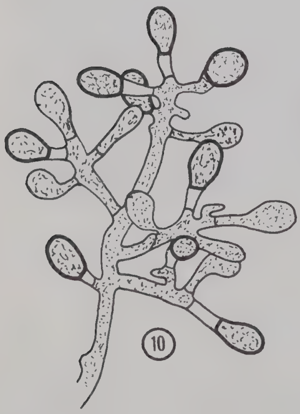

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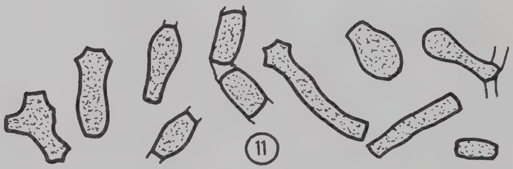

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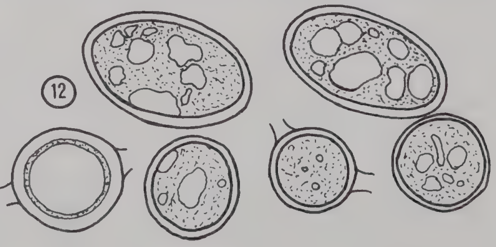

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Legend →

Aerial hyphae (Fig. 8) 2-4 µm diam, hyaline, thin walled, smooth or occasionally encrusted with long narrow crystals, septate, lacking clamps, branched frequently, these branches often developing as conidiophores; *submerged hyphae* (Fig. 9) (2.5-) 3.5-6 (-8) µm diam, mostly thick walled, occasionally thin walled in narrower hyphae, hyaline, smooth, septate, lacking clamps, frequently branched, usually at nearly right angles.

Conidia only on aerial hyphae; terminal persistent conidia (*aleuriospores* of Carmichael, 1962) (Fig. 10) 5-10 x 3-6 µm, ovate to elliptical, truncate at attachment to poorly differentiated conidiophore, smooth, hyaline, densely granular, sometimes guttulate, with slight wall thickening, not reacting with Melzer's reagent; arthric, retrogressive, fragmenting conidia (*arthrospores* of Carmichael, 1962) (Fig. 11) variable in size and shape (cylindrical, ovoid, clavate, branched, or fusoid), hyaline, densely granular, with slightly thickened walls, not reacting with Melzer's reagent; a third type of conidia (*chlamydospores* of Carmichael, 1962) (Fig. 12) terminal or intercalary, pyriform, spherical, to truncate-fusiform, hyaline, smooth, with densely granular contents and thick walls, up to 60 µm in longest dimension.

Temperature Relations: Average growth rates (mm radius/day) for the temperatures indicated are: 12C, 2-3 mm; 16C, 3-5 mm; 20C, 9-13 mm; 24C, 14-19 mm; 28C, 18-24 mm; 32C, 26-32 mm; 36C, 30-36 mm; 40C, 35-42 mm; 44C, 28-33 mm; 50C, 0-6 mm. According to the method of Davidson, et al. (1942) the key pattern would be A-O-F 2-3-4-10-14 or B-O-F 2-3-4-5-6-10-14-16. Using the method of Nobles (1965) the following species code is obtained: 1.6.14.24. 32.33.34.35.36.40.41.(48).54.55.

Cultures Examined: Polysporous isolates from basidiocarps: HHB 6251 (Holotype), MJL 98, and FP 104297. Isolates from decayed wood that have fruited in culture: ME-8 (from *Nyssa sylvatica* Marsh. [blackgum] wood chip, Brunswick, Ga.); ME-446 (from *Fagus grandifolia* Ehrh. [American beech] wood chip, Winslow, Me.); ME-450 (from

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Figs. 8-12. Zeiss drawing tube drawings of microscopic characters of cultures of *Phanerochaete chrysosporium*, HHB 6251. 8. aerial hyphae. 9. submerged hyphae. 10. aleuriospores and conidiophores. 11. arthrospores. 12. chlamydospores.

mixed *F. grandifolia, Betula* sp. [birch], *Acer* sp. [maple] wood chips, Winslow, Me.); ME-461 (from *Pinus* sp. [pine] wood chip, Fargo, Ga.); ML-20, ML-21 and ML-26 (all from *Sequoia sempervirens* (D. Don) Endl. [redwood] cooling tower, Kan.); FPL-V 170G (Shields' isolate from mixed *Abies balsamea* (L.) Mill.-*Picea mariana* (Mill.) B.S.P. [balsam fir-black spruce] wood chips, New Brunswick, Canada); QM 9145 (Nilsson isolate P127-1, from *Pinus* sp. wood chips, Sweden).

Cultures exhibiting only the imperfect state: ME-PC-8 (from *Pinus* sp. wood chip, Fargo, Ga.); ME-GC-15 (from *N. sylvatica* wood chip, Brunswick, Ga.); ME-OC-11 (from *Quercus falcata* Michx. var. *falcata* [southern red oak] wood chip, Brunswick, Ga.); ME-BC-10 (from *F. grandifolia* wood chip, Winslow, Me.); ME-BIC-6 (from *Betula* sp. wood chip, Winslow, Me.); ME-MC-7 (from *Acer* sp. wood chip, Winslow, Me.).

Remarks: Culturally this species differs from other *Phanerochaete* species studied in culture because of its *Chrysosporium pruinosum* imperfect state, its rapid growth rate and its high optimum temperature for growth, ca 40C. It is unusual in that it produces a white rot of wood but tests negative for extracellular oxidases as indicated by the Bavendamm test and tests with syringaldazine and gum guaiac (Harkin and Obst 1973).

DISCUSSION

The *Chrysosporium* state of this species has been repeatedly isolated from wood chip storage piles in North America, (as *Sporotrichum* sp. by Lindgren and Eslyn 1961; Saucier and Miller 1961; and Eslyn 1967; as *Ptychogaster* sp. by Shields and Unligil 1968, and Shields 1969; and as *C. pruinosum* by Smith and Ofosu-Asiedu 1972); in Sweden (as *C. pruinosum* by Nilsson 1965; and as *C. lignorum* by Bergman and Nilsson 1966, 1967, 1968, and 1971; Bergman, et al. 1970; Assarsson, et al. 1970); and in Poland (as *C. lignorum* by Zielinski 1973). In Sweden (Nilsson 1973) *C. lignorum* was noted to be the most common white rot fungus in all types of chip piles studied. Zielinski (1973) reported it to be one of the most frequently found fungi in two birch piles studied in Poland. The perfect state has been reported also (as "*Peniophora mollis* (Bres.) Bourd. et Galz.?") from redwood in cooling towers (Duncan nd Lombard 1965).

Because of its frequency of occurrence in wood chip storage piles and affirmative results of laboratory decay appraisals (Eslyn 1969), the species has been utilized extensively as a wood-rot test organism. Research by members of this laboratory based on the use of the isolates designated *Peniophora* "G" (ME-461) and *Chrysosporium* sp. (ME-PC-8) included: evaluation of chemicals for controlling biodeterioration in wood chip storage piles (Eslyn 1973a, b, and Springer, et al. 1969); determination of decay resistance of alkaline-treated wood (Highley 1973a, b); investigation of the chemistry of wood decay (Highley 1973c, and Kirk and Highley 1973); and evaluation of two methods of determining wood loss after fungal attack (Feist, et al. 1971).

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PEZIZA FLAVOVIRENS, AN OLDER NAME FOR VIBRISSEA PEZIZOIDES

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During the course of Dixon's (1972) monographic studies of *Chlorosplenium*, we had the joint opportunity to examine a specimen from the Fries Herbarium (UPS) labelled "*Peziza flavo-virens* Pers. - Myc. europ. p. 323. France, Mougeot." This is doubtless one of the specimens referred to by Fries (1822), "*In ligno putrido locis udis prostrato in Vogesia* (Mougeot) *& Smolandia cum praeced. Vere.* (v. v.)" It is very possibly part of the same material reported by Persoon (1822), "Hab. in Vogesia in ligno mucido prope rivulos." The specimen is in a fine state of preservation, and clearly provides an older name for the species described by Sánchez (1967) as *Vibrissea pezizoides* Lib. ex Phill. All authors subsequent to Persoon and Fries have merely repeated the brief diagnoses given by these authors, except Rehm (1896: p. 1262) who amplified his earlier description from a specimen (Rehm, Ascom. Exs. No. 1109) which is surely some other fungus. We provide the necessary new combination here:

Vibrissea flavovirens (Pers. : Fr.) Korf & Dixon, *comb. nov.*
≡ *Peziza flavovirens* Pers. (ut "flavo-virens"), Myc. Eur. 1: 323. 1822, : Fries, Syst. Mycol. 2(1): 139. 1822.
≡ *Helotium flavovirens* (Pers. : Fr.) Fr., Summa Veg. Scand., sect. post., p. 355. 1849.
≡ *Coryne flavo-virens* (Pers. : Fr.) Rehm, in Rabenh., Krypt.-Fl. II 1(3) (Lief. 35): 488. 1891.
≡ *Pachydisca flavo-virens* (Pers. : Fr.) Boud., Hist. Classif. Disc. d'Europe p. 93. 1907.
= *Vibrissea pezizoides* Lib. ex Phill., Trans. Linn. Soc. London II 2: 8. 1881.
= *Apostemidium torrenticola* Graddon, Trans. Brit. Mycol. Soc. 48: 643. 1965.

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POLYPORUS SQUAMOSUS IN UTAH

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Polyporus squamosus Micheli ex Fries, of common occurrence in Europe, is found less frequently in the United States even though it has now been collected in twenty-six states—twenty-three of which are cited by Overholts(1953). Distribution is primarily in the northeastern and midwestern United States. Shope (1931) found this species in the plains area of Colorado, then its westernmost station. Graff (1936) extended its range to western Montana, while Lowe and Gilbertson (1961) added Washington and Idaho. The present report adds Utah as a new record of distribution for the southwestern United States.

From the beginning of May to the first week of June 1974, P. squamosus was found growing on a living trunk of a wounded Acer negundo L. and on an adjacent stump close to Mill Creek in Mueller Park (Davis County) at an elevation of 5,400 feet. Three specimens had short lateral stipes 1.5-2.0 cm long, while two others had excentric stipes 3-5 cm long. The pilei ranged from 6-24 cm broad and were covered with dark brown scales, some of which were raised. The smooth hyaline spores measured 15.3 X 6.0μ. When specimens were picked, a watery exudate was noticed at the point of severance. Overholts (1953) states that the fungus is watery when young, but in none of the recorded descriptions is this watery exudate mentioned.

In addition to A. negundo, P. squamosus has been found on the following hosts listed by Graff (1936): Acer glabrum Torr., Aesculus octandra Marsh, Populus trichocarpa J. & G., Salix nigra Marsh, Ulmus americana L., Acer, Populus and Salix species. Overholts (1953) adds Betula, Celtis, Liriodendron, Tilia and Umbellularia. According to Smith and Smith (1973) P. squamosus is found frequently on elms.

Graff (1936) discusses the taxonomic history of the fungus. Lowe and Gilbertson (1961) add *Polyporus McMurphyi* Murr. as a synonym whereas Overholts (1953) accepts *P. McMurphyi* as a valid species.

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SOME COMMENTS ON PULCHROMYCES FIMICOLA FROM THE AMERICAS AS NOTED BY W. H. WESTON

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In the fall of 1972, while sorting the files of Prof. W. H. Weston, housed at the Farlow Herbarium and Library of Cryptogamic Botany, Gennaro Cacavio discovered a manuscript, several photographs, negatives, and specimens of a fungus which Prof. Weston had believed to be a new genus and species of Hyphomycetes. The manuscript, dated 1933, was never published. This material was inserted in the general mycological herbarium of the Farlow Herbarium where it was later found by Glenda Winn while she was performing some routine curatorial tasks. It was then brought to the attention of the senior author.

Study of Weston's illustrations and slides brought to mind a paper by Hennebert (1973) in which *Botrytis*-like genera were discussed. The generic identity of Weston's fungus was soon discovered. His manuscript, which anticipated publication of Hennebert's paper by 40 years and Dring's (1959) description of *Phymatotrichum fimicola* by 26, described fully *Pulchromyces fimicola* (Dring) Hennebert from American material. We have studied the type collection of *Phymatotrichum fimicola* kindly lent by the Curator of the Commonwealth Mycological Institute and find all our specimens to be unquestionably referrable to this single species.

One draft of Weston's manuscript was subtitled "An example of Dr. Thaxter's disconcertingly comprehensive knowledge of fungi." The following quote, from Weston's manuscript provides an historical note on this species. "Having found this striking and distinctive Hyphomycete on bat dung in the Panama Canal Zone in 1929, the writer, after a year's study of its structure and development, and careful examination of the literature, became convinced it was a rare new tropical genus. When, however, material was finally shown to Dr. Thaxter, he merely glanced at it, remarked drily 'imagine *that* turning up in Panama!' and from his collections brought out material collected in New Haven in 1888-89, Burbank, Tennessee and Cranberry, North Carolina, 1896, and Intervale, New Hampshire, 1901, already labelled [a new genus and species] though not published."

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The collections mentioned above, deposited in the Farlow Herbarium general mycological collection, were found on mouse dung, otter dung, and bat dung (Weston's Panamanian collection from Barro Colorado). Weston collected the bat dung from a hollow tree inhabited by fruit bats. Reference was made to this fungus by Weston in Stanley's flora of Barro Colorado (Stanley, 1933). Weston stated that "a few specimens of greater interest which were collected will be described elsewhere, a new species of *Rhinotrichum* by D. H. Linder [and] a new genus, *Aglaocephalum*, by Weston." *Aglaocephalum* Weston is a *nomen nudum* since no Latin description was provided in the Stanley publication or elsewhere. However, this was the first reference, in print, to this fungus.

The American collections studied by us agree with the type specimen (on mouse dung from Africa, IMI 73530) in conidial size, conidial ornamentation, and pigmentation of the conidial heads. We take one slight exception to Hennebert's description of the conidia as being reticulate at maturity. The reticulum, at best, is incomplete. Weston aptly described the conidial ornamentation as composed of "irregular whorls and loops like the patterns of finger prints." The ornamentation is also denser in collections we studied than shown by Hennebert (1973) in his figure 7.

Weston provided some information on conidium germination not previously reported. He found that the spores germinated within 2 to 8 hours in dung decoction, however,

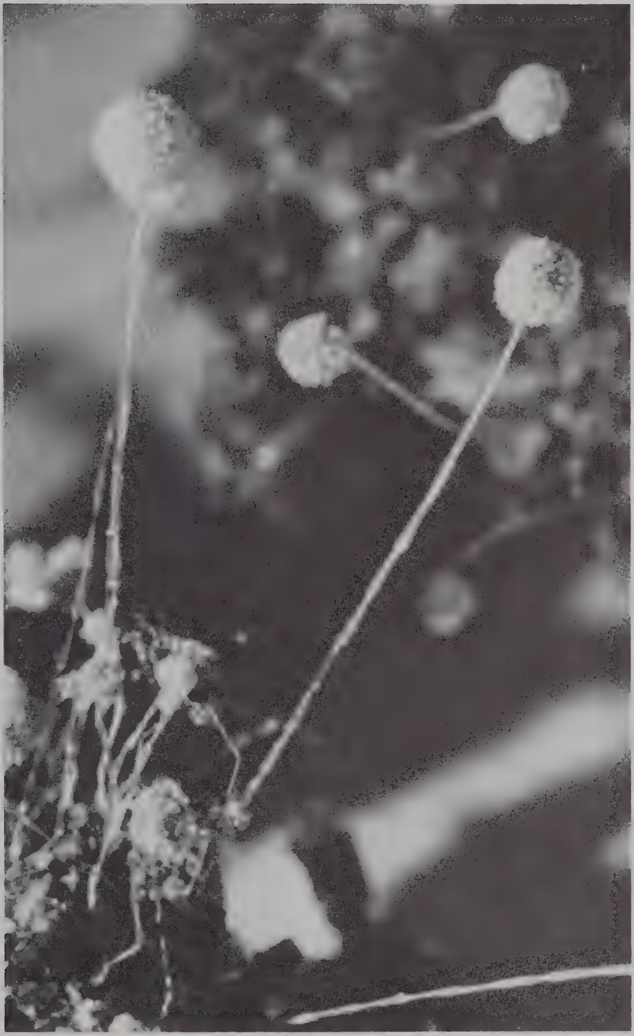
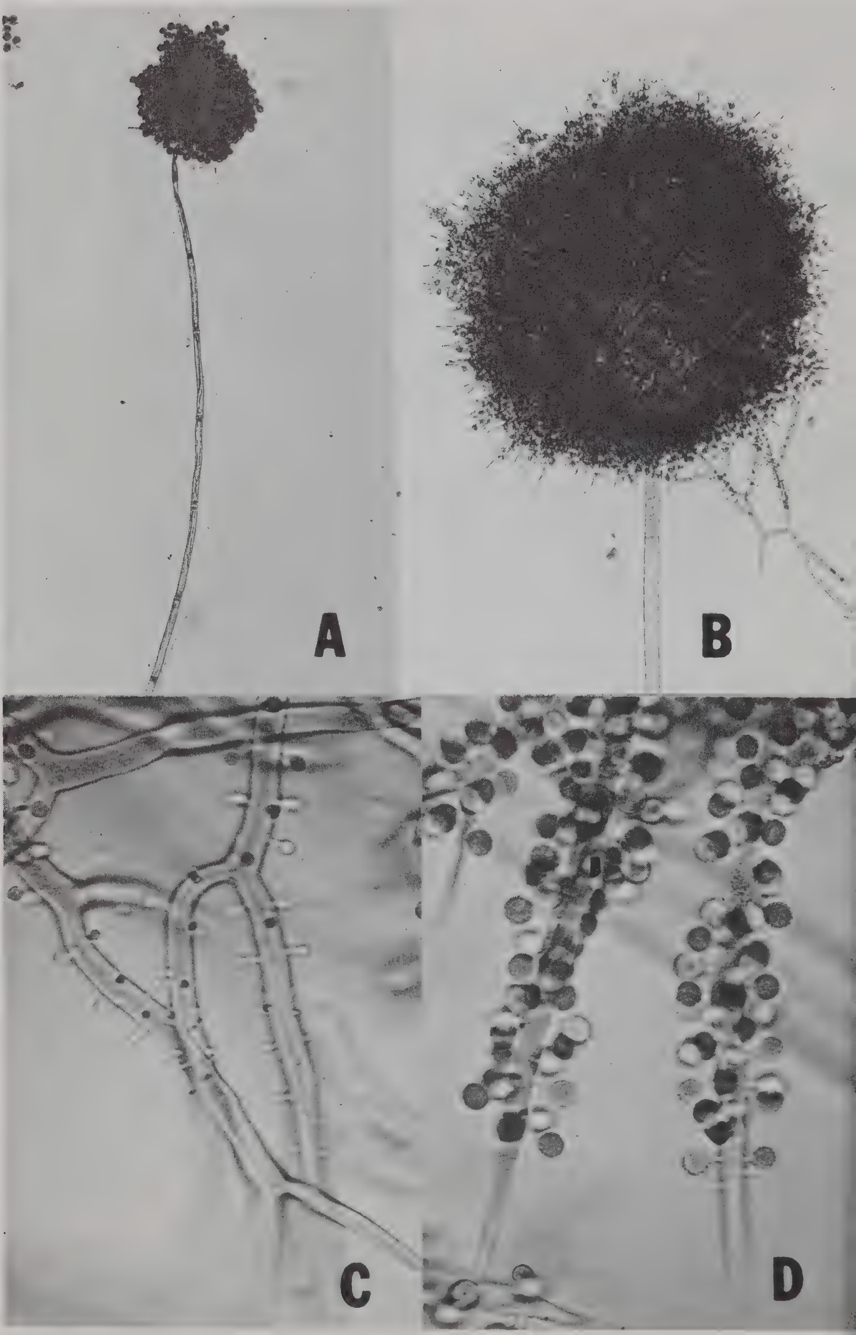


Fig. 1. *P. fimicola*. Habit photograph 15 x, from Weston's Panamanian collection.


A
B
C
D

there was no germination in pure water. The spores initially swelled, then produced stout germ tubes which ruptured the heavy outer wall. Growth continued on dung decoction but ceased immediately when the germlings were transferred to pure water. Cultures were established on cornmeal agar and potato dextrose agar to which rat dung had been added. Weston, like Hennebert and Dring, observed no perfect stage.

We have reproduced here as figures 1-2, Weston's excellent photographs of *Pulchromyces fimicola*. No photographs of this fungus have been published previously.

Our indebtedness to Prof. Weston is obvious; we thank him for sharing with us his enthusiasm and for granting us permission to quote from his manuscript as well as to use the photographs he prepared to accompany his original manuscript.

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Fig. 2. *P. fimicola.* (A) Young conidial head, approx. 13 x, from Weston's Panamanian collection. (B) Conidial head, approx. 44 x, from Thaxter's slide. (C) Developing conidia, approx. 396 x. (D) Mature conidia, appox. 396 x, from Thaxter's slide.

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I. M. A. NOMENCLATURE NOTICE

A STUDY IS TO BE MADE ON THE TYPIFICATION OF GENERIC NAMES WITH ALLEDGEDLY MISAPPLIED TYPE-SPECIES NAMES

An invitation to join in discussion is extended to all taxonomists who have wrestled with the problem of the typification of a generic name when the name of the type species is judged to have been misapplied, *i.e.*, when the species referred to as the type or sole species is alleged to be different from the material studied by the author of the generic name. A committee to study this problem is being set up under the auspices of the International Mycological Association's Nomenclature Secretariat, as their Subcommittee F. But because this is a problem not confined to fungus names, the participation of botanists interested or expert in the area would be very welcome. The purpose of the Subcommittee is to make specific proposals for changes in the Botanical Code that bear upon this matter. Persons desirous of participating in the work of the Subcommittee, which will be conducted by mail, should indicate their willingness in a letter addressed to the IMA Nomenclature Secretariat, Plant Pathology Herbarium, Cornell University, Ithaca, N.Y. 14850, USA. Five other Subcommittees are already at work (see notices in TAXON 22(2-3): 321-322. 1973, and in MYCOLOGIA 65(4): 984. 1973).

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NEW RECORDS AND DISTRIBUTIONS FOR SEVERAL LICHENS IN THE SOUTHEASTERN UNITED STATES

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ABSTRACT

Cladonia merochlorophaea is reported for the first time in the Southern Appalachian Mountains. Sticta limbata, also collected in the Southern Appalachians, is new to eastern North America. Heterodermia corallophora, previously known in North America from a single collection in Tennessee, has been collected at several localities in Florida and North Carolina. The previous report of Heterodermia microphylla in North America was based on a misidentified specimen.

1. The occurrence of Cladonia merochlorophaea Asah. in the Southern Appalachian Mountains.

The North American distributions of the four commonest chemically defined species of the Cladonia chlorophaea group were recently mapped by Bowler (1972). For one of these species, C. merochlorophaea, which produces merochlorophaeic and 4-O-methylcryptochlorophaeic acids, the southernmost locality in eastern North America was in western Pennsylvania. Similarly neither Kristinsson (1971) nor Skorepa (1972) reported C. merochlorophaea in either North Carolina or Tennessee respectively. However, in extensive collecting in the high-mountain areas in the Southern Appalachians in 1972 and 1973 I found that C. merochlorophaea is quite common there. Approximately 23% of the specimens belonging to the C. chlorophaea group were C. merochlorophaea while 43% were C. grayi Merr., 27% were C. chlorophaea (Flörke) Spreng., and 7% were C. cryptochlorophaea Asah.

Specimens of C. merochlorophaea examined (all collected by Dey and deposited in DUKE unless otherwise noted):

MOUNT ROGERS. --VIRGINIA. Smyth Co.-Grayson Co.: 5633, 5638.

ROAN MOUNTAIN. --NORTH CAROLINA. Mitchell Co.: Roan High Bluff, 2054, 5782, 5791; Laurel Ridge, 2059.

--TENNESSEE. Carter Co.: Roan High Knob, 2134; Carvers Gap, 2194; Jane Bald, 2257.

BLACK MOUNTAINS. --NORTH CAROLINA. Yancey Co.: Halfback Mtn., 6006, 6031, 6039; Mt. Mitchell, 730; Horse Rock, 5912, 5913, 5916; Celo Knob, 5902.

BALSAM MOUNTAINS. --NORTH CAROLINA. Jackson Co.-Haywood Co.: Richland Balsam, 4756.

PLOTT BALSAM MOUNTAINS. --NORTH CAROLINA. Jackson Co.-Haywood Co.: Waterrock Knob, 6334.

GREAT SMOKY MOUNTAINS. --NORTH CAROLINA. Haywood Co.: Spruce Mtn., 3431A. Swain Co.: Andrews Bald, 2775. --NORTH CAROLINA (Swain Co.)-TENNESSEE (Sevier Co.): Mt. Buckley, 2451; Eagle Rocks, 6476. --TENNESSEE. Sevier Co.: Mt. Sequoyah, 6516; Mt. Guyot, 6614.

2. Sticta limbata (Sm.) Ach., new to eastern North America.

Four collections of Sticta limbata from western North Carolina are the first known localities for this species in eastern North America. Previously S. limbata was known in North America only along the Pacific Coast. The presence of soredia in marginal soralia readily distinguish this species from the other eastern Sticta species. Nephroma parile Ach. and Erioderma mollissimum (Samp.) Du Rietz, two other local superficially similar sorediate lichens, are readily distinguished from S. limbata by the lack of cyphellae on their lower surfaces.

Specimens examined:

BLUE RIDGE MOUNTAINS. --NORTH CAROLINA. Burke Co.: Linville Falls, 7495 (HERB. DEY), 7516 (HERB. DEY, DUKE).

GREAT SMOKY MOUNTAINS. --NORTH CAROLINA. Haywood Co.: Big Cataloochie, 3628, 3630.

3. The distribution of Heterodermia corallophora (Tayl.) Skorepa in North America.

Degelius (1941) made the only report of Heterodermia corallophora (as Anaptychia corallophora) from North America based on a single specimen from rock at Cherokee Orchard, Great Smoky Mountains National Park, Tennessee. In his monograph Kurokawa (1962) cited no specimens of this species from North America and indicated that this species seemed to be restricted to Central and South America and the West Indies. The additional collections of this rare species cited below extend the known range in the United States from Tennessee to North Carolina and south to Florida. Heterodermia granulifera (Ach.) W. Culb., the only other local isidiate Heterodermia, produces salazinic acid and has a corticate lower surface, which distinguish it from H. corallophora. The latter species lacks salazinic acid and has an ecorticate lower surface pigmented yellow-orange (K+ red-purple).

Specimens examined:

FLORIDA. Columbia Co.: O'Leno State Park, 7636 (HERB. DEY, DUKE). Citrus Co.: 4 mi. S. of Inverness, 8189 (HERB. DEY). --NORTH CAROLINA. Brunswick Co.: Smith Island, Culberson 7957. Transylvania Co.: Thompson River Gorge, Moore 1613.

4. *Heterodermia microphylla* (Kurok.) Skorepa misreported from North America.

Yoshimura and Sharp (1968) made the only report of *Heterodermia microphylla* (as *Anaptychia microphylla*) from North America based on a single collection (Moore 618, TENN) from Mt. LeConte, Great Smoky Mountains National Park, Tennessee. Recently I examined this specimen and discovered that it has a corticate lower surface and sparse soredia in labriform soralia. This specimen is *H. tremulans* (Müll. Arg.) W. Culb., not *H. microphylla*. Thus Kurokawa (1972) was correct in doubting the occurrence of *H. microphylla* in North America. *Heterodermia microphylla*, an endemic of Japan, has an ecorticate lower surface, lacks soredia, but has marginal squamules.

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ON THE TYPIFICATION OF SCLEROTINIA

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Publication of the generic name *Whetzelinia* Korf & Dumont (1972) for a common plant pathogen, *Sclerotinia sclerotiorum* (Lib.) dBy., and for one or a few additional species previously assigned to *Sclerotinia* led (a) to a proposal for conservation of *Sclerotinia* with *S. sclerotiorum* as its type species (Buchwald and Neergard, 1973), and (b) to a conclusion that *Whetzelinia* is a superfluous name (Dennis, 1974).

Dr. Dumont and I had come to these conclusions:

(1) Honey (1928) had effectively designated *S. candolleana* (Lév.) Fckl. as the type species of *Sclerotinia* Fckl. 1870;

(2) in our opinion, *S. candolleana* and *S. sclerotiorum* belong in different genera;

(3) the only way *Sclerotinia* could continue to be used as a generic name for *S. sclerotiorum* simultaneously excluding *S. candolleana* from the genus would be to conserve *Sclerotinia* with *S. sclerotiorum* or *S. tuberosa* as its type species;

(4) since there are at most a few species involved, proposing conservation for such a small genus might be considered foolish, even though one species is a common and economically important plant pathogen;

(5) proposal of a new generic name *(Whetzelinia)* would accomplish our ends more simply than would a formal conservation proposal processed through the Botanical Congresses.

Buchwald and Neergard (1973) are in apparent agreement with points (1), (2), and (3), above, but hold that there is sufficient literature using the name *S. sclerotiorum* to merit conserving *Sclerotinia* for it. They propose not to conserve *Sclerotinia* against any earlier, competing generic name, but rather to conserve a type species for that generic name. Precedence for just such a peculiar procedure already exists: three generic names of fungi, *Agaricus* Fr., *Boletus* Fr., and *Sordaria* Ces. & de Not. were so conserved merely to fix permanently a type species for each of these generic names.

How many plant pathologists would support such a conservation of *Sclerotinia* is difficult to judge. At a "*Sclerotinia* Workshop-Conference" held Oct. 30 - Nov. 1, 1974, at Beltsville, Maryland, and attended by over 30 of the U.S. and Canadian workers most actively studying *S. sclerotiorum*, I had the opportunity of presenting the arguments both in favor of and opposed to conservation. They were later polled, and were divided in their opinion, nearly 2/3 favoring typification of *Sclerotinia* by *S. sclerotiorum,* over 1/3 favoring typification by *S. candolleana.*

Dennis (1974) specifically denies point (1) of the Korf and Dumont rationale. He holds that since Honey (1928) had applied principles of the American Code of Nomenclature, specifically the "first species rule," Honey's typification was thereby arbitrary, and we are not obliged to accept it. If so, Clements and Shear's (1931) designation of *S. sclerotiorum* as the lectotype can be accepted; then, necessarily, *Whetzelinia,* based upon the same species, will fall in synonymy. He also champions designation of *S. sclerotiorum* as the conserved type species for *Sclerotinia,* "thus rendering *Whetzelinia* Korf & Dumont superfluous."

Lectotypification is an exceptionally important act in nomenclature, and the Code (Art. 8) insists that the author who *first* proposes such a lectotype "must be followed, but his choice is superseded ... if it can be shown that the choice ... was made arbitrarily." Korf and Dumont (1972) were well aware that the "first species rule" of the American Code was at least partly, perhaps even predominantly, the basis for Honey's (1928) statement, "Type species for these four genera have been designated following the principle of types as outlined in the American code of botanical nomenclature." They were also aware that *other considerations* had crossed Honey's mind and were weighed by him in arriving at his typifications. In the same paper Honey (1928) wrote of another genus: "Fuckel did not designate a type species; yet, because it is the first binomial listed under the genus *Ciboria,* and because this is further supported by citations to illustrations, *C. Caucus* (Reb.) Fuckel is chosen as the type species for the genus *Ciboria* Fuckel." Dennis (1974) seems in error in assuming that Honey "did not make a choice, he thought one was imposed on him by the First Species rule of the American Code of Nomenclature."

Is Honey's designation of *S. candolleana* as the type of *Sclerotinia* truly arbitrary, as Dennis (1974) contends, or is it of sufficient weight that it cannot simply be overthrown by those like Whetzel (1945) who prefer another lectotype, as Dumont and Korf (1971) and Korf and Dumont (1972) held? It is now my belief that there is no clear way to resolve this dilemma short of action by the International Botanical Congress to designate a lectotype species for *Sclerotinia.*

One such proposal (Buchwald and Neergard, 1973), and a restatement of it (Dennis, 1974), to designate *S. sclerotiorum* as the lectotype is already before the Special Committee for Fungi and Lichens of the International Association of Plant Taxonomists. An alternative proposal, which would be preferred by at least some of the *Sclerotinia* workers, is formally proposed here for consideration by that Special Committee. It has the virtue of supporting the first known typification of the genus, rather than of overturning it.

ALTERNATIVE PROPOSAL: To designate *Peziza candolleana* Lév. as the conserved lectotype species of *Sclerotinia* Fckl., Jahrb. Nassauischen Vereins Naturk. 23-24: 330. 1870.

COMMENT: Those authors who have a broad generic concept for *Sclerotinia* which includes both *S. candolleana* and *S. sclerotiorum* need express no preference for a lectotype species, since designation of either species will allow the continued use of *Sclerotinia sclerotiorum* as a correct name for the plant pathogen of economic importance.

REASONS AGAINST THIS PROPOSAL: Those authors who wish to adopt a narrow generic concept for the common plant pathogen, *S. sclerotiorum,* would be forced to select either *Myriosclerotinia* Buchw. 1947 for it (if they consider *S. scirpicola* Rehm, generitype of that name, to be congeneric), or *Whetzelinia* Korf & Dumont 1972 for it (if they consider *S. scirpicola* to be a member of another genus). The literature on *S. sclerotiorum* is so vast that such a change in names would be confusing. *S. candolleana* and its allies already have an available generic name, *Ciborinia* Whetz. 1945.

REASONS FOR THIS PROPOSAL: Within perhaps a decade much of the recent literature on *S. sclerotiorum* and its very few close relatives could be retrieved under the unambiguous name *Whetzelinia* rather than being diffused under *Sclerotinia*. Nearly all of the more than 275 epithets combined under *Sclerotinia* are no longer considered congeneric with *S. sclerotiorum* by modern taxonomists. *Sclerotinia,* even in the recent literature, is a genus of widely varying limits according to the author consulted. (In parts of Europe it continues to be used in a very wide sense: Dennis's (1968) arrangement places in synonymy with it *Botryotinia, Ciborinia,* and *Myriosclerotinia;* Dennis's (1958) treatment synonymizes not only these three genera, but also *Ovulinia* and *Stromatinia.*)

Literature cited: BUCHWALD, N.F. & P. NEERGARD. (1973) A plea for the retention of *Sclerotinia sclerotiorum* as type species for the genus *Sclerotinia* Fckl. emend. Friesia 10: 96-99. — CLEMENTS, F.E. & C.L. SHEAR. (1931) The genera of fungi. New York. — DENNIS, R.W.G. (1958) A revision of the British Helotiaceae in the herbarium of the Royal Botanic Gardens, Kew, with notes on related European species. Mycol. Pap. 62; (1968) British Ascomycetes. Lehre; (1974) *Whetzelinia* Korf & Dumont, a superfluous name. Kew Bull. 29: 89-91. — DUMONT, K.P. & R.P. KORF. (1971) Sclerotiniaceae I. Generic nomenclature. Mycologia 63: 157-168. — HONEY, E.E. (1928) The monilioid species of *Sclerotinia*. Mycologia 20: 127-157. — KORF, R.P. & K.P. DUMONT. (1972) *Whetzelinia,* a new generic name for *Sclerotinia sclerotiorum* and *S. tuberosa*. Mycologia 64: 248-251. — WHETZEL, H.H. (1945) A synopsis of the genera and species of the Sclerotiniaceae, a family of stromatic inoperculate discomycetes. Mycologia 37: 648-714.

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SPECIFIC AND INFRASPECIFIC NAMES FOR FUNGI USED IN 1821. PART I. INTRODUCTION, A & B.[1]

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Summary

A discussion of the mycological literature which was issued in 1821, and to the pre-1821 source literature is introduced, and an annotated list of this literature is included. Specific and infraspecific fungus names used in 1821 are listed, and their nomenclatural history is outlined.

Just at this time, there is growing unrest with the system of multiple starting points for nomenclature of fungi. Some proposals have been made recently to change this system, the most radical being to revert back to 1 May 1753 for a starting date for all fungi. In order to be able to competently deal with such a proposal, however, it is essential that mycologists have a basic understanding of the implications and ramifications of the *present* system. A brief introduction to nomenclatural cases has led me to the conclusion that, at least in regard to the problem of starting point, this basic understanding does not exist.

First, it would seem elemental that mycologists know what literature appeared at or very shortly after the starting date. On this point, very little has been published (Rogers, 1941, 1951, 1954). The late M. A. Donk was informally able to add several more references to the 1821 literature alone, but still a number remained to be discovered. Undoubtedly not all have been dusted off yet, but in my opinion, the lion's share, including all *major* contributions, have now been resurrected.

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[1] This paper represents contribution No. 438 from the Botanical Laboratories, University of Tennessee.

Second, as a student of the basidiomycetous fungi, I have been more concerned with the starting date for "Fungi Caeteri" than for the groups with earlier starting dates. Therefore, my study has centered on the literature and names appearing in the literature of 1821 and shortly thereafter. This paper, in fact, is a compilation of (only) those fungus names appearing in 1821, and includes only names belonging to groups whose starting date is 1 January 1821.

Third, I suspect that the only way in which the 1821 starting point system can be shown either workable or untenable is by its rigorous exercise. It is exactly this exercise which I hope this series of papers will provide, by furnishing a list of fungal specific and infraspecific names which appeared in 1821, and the origins of these names. For the time being, the reader must draw his own conclusion as to the worth of the 1821 system, but suffice to say that *names adopted in the* 1821 *literature can be systematically traced to their origins*, and presumably, those names which escaped until 1822 or later may equally be hunted down *in systematic fashion*, so that future investigators may make use of them without individually performing the laborious library search.

Fourth; by comparison of a given name to this list, two basic units of information become available. 1) If the name appears in the list, it was adopted in the 1821 literature, and its origin is traced. 2) If the name does not appear in the list, it was not validated in the literature searched, and validation probably took place *after* 1821. In this regard, the reader is referred to the concordance of Le Turquier de Longchamp, which appeared in 1826, and which compiled *all* names used by Bulliard, Persoon, De Candolle, and Fries in various ways and to the "Nomenclator" of Steudel (1824) which listed most of the names of these workers, with synonyms indicated in italics, thus validating most of these names in that year. So for names not appearing in the list here presented, the search generally for validation narrows to a date from 1822 through 1824, but hardly later. In most instances, there is no need to use the later volumes of Fries for validation sources of pre-1821 names, but only as "sanctioning" books, as suggested by Donk.

Care must be taken in using this compilation to separate taxonomy from nomenclature very sharply. I have made no attempt whatsoever to trace the taxonomic concepts behind the representative names, but only to trace the names themselves, as directed by the 1821 validating authors. Thus the taxonomic concept behind the name *Agaricus aurantiaca* differs sharply with the various pre-1821 authors, nevertheless the ancestry *of the name* seems quite distinct.

Very quickly in such a bibliographic search, it becomes obvious that two strong strains of early literature exist. One of them sprang from the French literature, notably Bulliard ("Herbier...") and De Candolle ("Flore Francaise..."), but also including Lamarck. The French 1821 literature almost exclusively cited these authorities plus Persoon's *Synopsis*. Conversely, there was a strong intra-English tradition including Curtis ("Fl. Londinensis...") Abbot ("Flora Bedfordensis..."), Hudson ("Fl. Anglica..."), Relhan ("Fl. Cantab..."), Withering ("Arrangement...") and chiefly Sowerby ("English Fungi..."). The English literature of 1821 heavily cites from these authors, largely ignoring Persoon (with the notable exception of Gray). But the extremely important key to the whole search is Persoon, for the continental compilers of 1821 used names from Persoon (through Bulliard and De Candolle), and Persoon (chiefly his "Synopsis" and "Observations") cited the preceding English workers. Thus many names attributable to English authors can be legitimately traced from continental compilers through the "Codex" of Persoon. Furthermore, Persoon introduced large numbers of names for the first time as well. Hence Persoon becomes a sort of nomenclatural screen, passing through many prior names, screening out many others, and adding large numbers of his own. Almost all Persoon's names were adopted within the span of the "starting point" books (1821-32).

Actually, the number of sources for fungus names is remarkably small. With the assumption that scores of sources would require search, the actual limited source material was a pleasant surprise. Presumably, the 1821 writers had access only to certain sources, and especially in the French school, did not consider compilers and general floricists worthy of reference.

Of course, subordinate only to locating the 1821 literature is the problem of sequencing these references, for the validating author will be determined by priority of publication after the starting date. Fortunately, partial success can be achieved in this endeavor. Some insight has been shed already on the relative placement during 1821 of S. F. Gray's "Natural Arrangement," Purton's "Appendix to the Midland Flora," Mérat's "Flore Bordelaise" (Rogers 1943, 1951, 1954) and Fries's "Systema" by legislation. I can add the following points.

Forster's "Introduction" (published anonymously) probably appeared quite late in 1820 (or quite early in 1821), for its title page reads 1820, while the reference by Willström cites it as 1821. I have quite arbitrarily decided to consider it as pre-1821 for two reasons. First, it probably was indeed pre-1821. Second, with no author of record on the publication itself, it might be possible to mistake the publication as linked to Forster. In this event, validation cited as "*Fungus quiaelibet* [Doe] Anonymous" would obviously be controversial. So happily, the title page date may relieve the problem of author citation. Yet, future bibliographic studies may reveal the true *effective* date of publication to be after 1 January 1821.

The title page of "Flora o. Bot. Zeitung" no. 22 reads 14 June 1821, and I can find no reason to dispute this general date. If Rogers was correct in his conclusion that Mérat's "Flore Bordelaise" appeared during the week of 9-15 June, 1821, I am ready to (arbitrarily) assume that Ritter van Schrank's publication in "Flora" came thereafter.

Purton's "Appendix" Part 1 (p. 314) cites Hooker's "Flora Scotica" and so this portion of Purton's publication appeared some weeks or months after Hooker. Rogers has concluded that Purton's "Appendix" was issued after August 1, and quite possibly significantly later, making placement of Purton less definite.

Ehrenberg's review in "Flor o. Bot. Zeitung" no. 33 was dated (title page) 7 September 1821, and I can find no reason to doubt this.

Laterrade (p. 477) discusses the collecting season of 1821, in regard to *Amanita verna*, which probably did not fruit until very late June. Again, given time for process-ing, it is likely that this work did not appear until fall or early winter.

The parts of Zantedeschi's "Continuazione" may be generally dated as follows: 1) the first 1821 portion appeared in a fascicle entitled "Secondo Bimestre Marzo, e Aprile 1821." The latter month is quite accurate, apparently, for there appear references to "Ann. Gén. des Sciences Phys., Fev. 1821" (p. 157) and "Journ. de Pharm., Fev. et Mars 1821" (p. 158), and a table of climatological data on the last page of the issue runs *through* March 31. Thus April is not an injudicious guess for a time of effective publication. 2) The fascicle including Zantedeschi's second 1821 offering is entitled (p. 259) "Quarto Bimestre Luglio, e Agosto 1821." Again, August is probable as an issue period, for the last page of the fascicle bears the notation "Modena adi 22 Luglio 1821." The following fascicle, "Quinto..." includes climatological data *starting* July 1, perhaps indicating that July's data had not been readied when "Quarto Bimestre" was sent to the publisher. 3) Zantedeschi's third 1821 contribution may be dated probably in October. The title page states "Quinto Bimestre Settembre, e Ottobre 1821," and climatological data on the final page runs *through* September 30. 4) Another chapter has been ascribed to Zantedeschi in 1821, but, although the fascicle is entitled "Sesto Bimestre Novembre, e Dicembre 1821," the climatological data included on the final page runs *through* December 31, making appearance of the fascicle in 1821 virtually impossible. I am ready to dismiss it for purposes of the present list of fungus names from 1821.

Sayre (1959) also cites Borén (1920, not seen) as giving 1821 as the year of publication of "Svensk Botanik..." vol. 9, which includes redescriptions and colored illustrations of a few agarics included by Fries in his "Systema." Because of their inclusion in "Systema," their inclusion in "Svensk Botanik" has little nomenclatural importance. I cannot find a more accurate date of publication.

Hooker's publication of Curtis's "Flora Londinensis..." is also impossible to accurately date. According to Sayre (1959), the fascicles were produced unnumbered, so that each binder could arrange the plates as met his desires. The individual plates were often (although not invariably) numbered, with the accompanying text numbered identically.

The bound copy at Kew, for example seems to be arranged "phylogenetically" within fascicles, so that the fungi are near or at the beginning of fascicles 1 and 2 of volume 4. Conversely, Sayre cites 1821 as the publication year for the entire volume, but only fascicle 2 is so dated on the title page. I cannot find a more accurate date. "Flora Londinensis..." includes references to Hooker's "Flora Scotica", but even these may have been taken from galley proofs by Hooker, making an accurate estimate for dating impossible.

Fascicle 29 of "Flora Danica..." edited by Hornemann is dated (p. 13) September 1821. With time allowed for printing, the fascicle probably appeared rather late in 1821, but I cannot pinpoint the date more accurately.

The date of appearance of Gray's "Natural Arrangement" is controversial. Rogers (1941, 1951) has given November, but most recently (in a letter in response to a query on the subject) has stated the earliest possible date to be 21 November. Conversely, Sayre (1959) gives 10 September. Because of Rogers's newer information, I am inclined to accept the later date.

In the same communication, Rogers also noted that Purton ("Appendix" part 2, p. 574) cites the date 20 September 1821 (with the assumption that publication must have been subsequent to that date), and that the Linnaean Society of London received the volume on 6 November. Moreover, Rogers gives evidence that St. Amans's "Flora Agenaise" appeared in the week of 20-28 April.

The elogy to Palisot de Beauvois by Thiébaut-de-Berneaud contains only a single species name (*Microspheria polymorpha*) with no author citation, and so is of little consequence. I can find no implicit means of sequencing the publication. It might be mentioned, however, that the genus name *Trichospermum* is also used (p. 39), but with a reference to an unpublished memoir of the Institute. This constitutes no validation, therefore, and a later valid description must be sought, and the name given priority only from that later date.

The dates of the "Dictionnaire des Sciences Naturelles" may be ascertained with unusual accuracy from Sayre (1959). They are as follows: vol. 18, 6 April 1821; vol. 19, 26 January 1821; vol. 20, 29 June 1821; vol. 21, 29 September

1821; vol. 22, 29 December 1821.

The preface to Krombholz's small volume was dated 1 November 1820, and allowance for normal time in press suggests an appearance early in 1821, although not with accuracy. If this date is compared with the dedication of "Nova Acta... Academiae Caesareae Leopoldino-Carolinae" (18 October 1820), and an arbitrarily equal time is allotted for the press in each case, then the latter may be dated before the former, but this may well not be the situation.

Sayre (1959) supplies a date (through a review) of 10 May 1821 for Hooker's "Flora Scotica", the preface of which is dated 10 April 1821. This surely represents a short press time, and may well indicate that portions of the work had been printed before receipt by the printer of the preface.

Insofar as I can tell, then, the sequence of appearance of 1821 fungus literature is as appears in Table I.

Of all the authors of validating literature in 1821, only Fries directed the reader to a specific authority for each name. Fries's choice of authority was not cited in the text, but in the index to volumes 1 and 3. In most cases, the author cited in the index matched one of those in the protologue, but in rare instances this was not the case. Moreover, some question may be raised as to whether Fries simply gleaned the name of the taxon from the authority cited in the index, or whether the taxonomic concept of that author was co-opted also. The latter would seem the case.

One of the more cumbersome nomenclatural situations surrounds the various issue dates of the plates and text of Bulliard's "Histoire des Champignons..." (really a division of his "Herbier de la France..."). On one hand, virtually all the plates were issued before any portion of the text. Several fascicles of plates were issued in time for citation by later writers like Persoon in 1801. But none of the plates were accompanied by descriptions, and some bore only vernacular names, and so the plates themselves cannot bear priority. Indeed, several of these names were adopted by later authors (notably Persoon), who supplied descriptions *before* those furnished by Bulliard himself. Strictly speaking, such names should not be attributed to Bulliard, but to the author who supplied a protologue. For purposes of this paper, however, it is clear that Bulliard was the name-bringer and so both the plate number and text page are

Table I.

Possible sequence of 1821 fungus literature

	Publication	Date[1]	Source
1.	Fries, "Systema" vol. 1	1 January	Legislation
2.	"Dictionnaire" vol. 19	26 January	Sayre (1959)
3.	Sprengel, "Neue Entdeckungen"	early	Stafleu (1967)
4.	"Nova Acta..."	early	date of dedication
5.	Krombholz	early	date of preface
6.	Zantedeschi, "Continuato"	April	p. 169, data through 31 March
7.	St. Amans, "Flore Agenaise"	20-28 April	Rogers (see text)
8.	Hooker, "Flora Scotica"	10 May	Rogers (1951)
9.	Mérat, "Nouvelle Flore"	9-15 June	Rogers (1954)
10.	Ritter v. Schrank	14 June	Title page fascicle
11.	"Dictionnaire" vol. 20	29 June	Sayre (1959)
12.	Zantedeschi, "Continuato"	3 August	p. 337, "22 Luglio 1821"
13.	Purton, "Appendix" pt. 1	after 1 August	p. viii: Rogers (1954)
14.	Ehrenberg, "Flora"	7 September	Title page of fascicle

15.	"Dictionnaire" vol. 21	29 September	Sayre (1959)
16.	Zantedeschi, "Continuato"	4 October	p. 414, data through 30 September
17.	Purton, "Appendix" pt. 2	early November	Rogers (see text)
18.	Latterrade, "Flore Bordelaise"	fall or winter	p. 477, reference to *A. verna*
19.	Gray, "Natural Arrangement"	21 November	Rogers (see text)
20.	Schleicher, "Catalogus"	December	see text
21.	"Dictionnaire" vol. 22	29 December	Sayre (1959)

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[1] Forster is considered pre-1821: Zantedeschi, "Continuato" 4 is considered post 1821: unsequencable (see text) are Foderé; Fries's "Scleromyceti;" Fries's "Brand och rost på wäxter;" Hooker *in* Curtis; Nocca & Balbis; Re; Roques; Thiébaut-de-Berneaud; Flora Danica; Svensk Botanik.

cited.

To make the situation a bit worse, Bulliard died before completing the printing of the plates (although they were all engraved with Bulliard's names) and before writing some of the text. The introduction to volume two, part one states that all the text *after* page 508 was written by Ventenant, including the descriptions (but not the names). In some cases (see the concordance at the rear of volume two), Ventenant considered one Bulliard name to represent two or more species, and so some names given by Bulliard in his plates disappeared in subsequent treatment in the text, although usually cited as synonyms. Strictly speaking then, some "Bulliard" names should be attributed to Ventenant, who supplied them with a protologue.

Although Vol. 1, Part 1 bears a title page date of 1809, Rickett (North American Flora, Vol. 1, Part 1) has concluded that this part, at least, was published in 1791.

Many authors have made some distinction between Bulliard's "Herbier" and his "Histoire," but Bulliard did not (expect for two divisions of the same work), and none is made herein.

A few symbols require explanation. Pre-1821 literature sources have been placed within square brackets. While recognizing the omission of this symbol from the Seattle Code, it is consistent with previous Codes, and I find the symbol especially useful.

Each name is initially cited from the 1821 literature, with abbreviated citation to author. This citation is followed by an arrow indicating the direction of the original name-giving process. The citation(s) which follow constitute the "original" source(s) of the name, insofar as I can verify it. Variations in spelling (orthographic variants - *in my estimation*) are indicated in quotes, while other genera under which the name was included are enclosed in parentheses. *Tremella* was considered variously as an algal or fungal genus, and this is noted where appropriate. Finally, original literature sources I have not actually seen are indicated in quotes, for I have them only on the authority of authors.

Under normal circumstances, the number of such "second-hand" citations would have been reduced materially before publication, but with moves afoot to change the starting date system, publication in as short a time as possible becomes important, and I trust that most of the second-hand citations will turn out to be correct.

The symbol for death, the dagger (†), has been used to denote names and/or citations which are doubtful or moribund. In most cases, the name has been only doubtfully placed in the cited genus, and therefore needs further clarification, and in others the name is contrary to the Code for some reason (i.e. only a vernacular name appears in many BH citations, contrary to the Code).

An example of the process follows.

abietina (Thelephora) Fr: 442 ← [FO 2: 274 (Stereum) ← PS: 573 (Thelephora)]

The name *Thelephora abietina* appears on page 442 of Fries's "Systema", volume 1, in 1821. Fries directs the reader to the name supplied by Persoon, so it is this author who is cited as "original". The name *abietina* (as representing this species) first appeared in Persoon's "Synopsis" (PS: 573) under the genus *Thelephora*. Later, Fries himself, in his "Observationes" (FO) used the name, but under the genus *Stereum*. It was this name, with this history, which was adopted by Fries in 1821.

There are a number of literature citations which I have not been able to examine as yet. Many of them are general titles, with no assurance that fungi are discussed or mentioned. The following reference, although ostensibly dealing with lichens (not covered under this starting date), includes several fungi according to Dr. Hawksworth (personal communication), but I have not seen it, and names from it are therefore not included in this summary.

Schaerer, Eman. 1821. Lichenes helvetici parenchymate pulveraceo instructi. Naturwissenschaftlichen Anzeiger der allgemeinen Schweizerischen Gesellschaft für di Naturwissenschaften. 1 (Wintermonat no. 5): 33-37.

Acknowledgements and dedication

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The New York Botanical Garden has perhaps the best library under one roof in North America, and the staff there has been most cooperative. Rivaling or surpassing that single institution are the collective libraries of the National Fungus Collections and the U. S. Department of Agriculture Library at Beltsville, Md., the Library of Congress and the Smithsonian Institution library in Washington, D. C. In all these libraries, the librarians have been courteous and helpful.

In Europe, I have consulted the excellent libraries at Leiden (L), Uppsala (UPS), Geneva (G), British Museum (BM) and Kew (K). The library staffs have been uniformly helpful.

Because of his enormous influence on my thinking and career, and his constant inspiration, after death as well as before, I dedicate this series to the memory of Dr. M. A. Donk.

The 1821 *Literature*

E: Ehrenberg. 1821 (published anonymously). I. Recensionen. Horae physicae Berolinensis collectae ex symbolic vivorum doctorum Linkii, Rudolphi, Klugii, Nesii ad Esenbeck, Ottonis, de Chamisso, Hornschuch, a Schlechtendahl et Ehrenbergii edi curavit Dr. C. G. Nees ab Esenbeck. Flora o. Bot. Zeitung (Regensburg), no. 33: 509-522.

ENA: Ehrenberg, C. G. 1821. De Mycetogenesi. Nova Acta Physico-Medica Acad. Caesareae Leopoldino-Carolinae. Nat. Cur. 10: 161-222.

F: Foderé, Fr. Em. 1821. Voyage aux Alpes Maritimes, ou histoire naturelle, agraire, civile et médicale, du compté de Nice et pays limitrophes; enrichi de notes de comparais avec d'autres contrées. Tome premier. xxiv + 376 pp. Paris.

FBR: Fries, E. 1821. Om brand och rost på wäxter, sente fullständig underrättelse om deras kännetecken, orsaker, skada samt medel till dess förekommande. 54 pp. Lund.
[A copy of this rare paper was furnished by Dr. Lennart Holm, to whom I extend my thanks.]

Fr.: Fries, E. 1821. Systema Mycologicum, sistens fungorum ordines, genera et species, huc usque cognitas, quas ad normam methodi naturalis determinavit, disposuit atque descripsit. Vol. 1: lvii + 520 pp. Lundae.
[The commentary by Stafleu (1967) is interesting. The volume apparently was quickly reprinted, with the original edition bearing "Ex officina Berlingiana," and the reprint "Gryphiswaldae, sumtibus Ernesti Mauritii" on the title page.]

FSS: Fries, E. 1821. Scleromyceti Sueciae.
Decades XV - XVIII. Lund. [nos. 141-180]
Decades XIX - XXII. Lund. [nos. 181-220]
[The full first edition of this exsiccati may be found at BPI. The most informative paper on this work is that of Holm & Nannfeldt, 1963.]

G: Gray, Samuel Frederick. 1821. A natural arrangement of British plants according to their relationships to each other as pointed out by Jussieu, De Candolle, Brown, etc., including those cultivated for use; with an introduction to botany in which the terms newly introduced are explained.
Vol. 1. xxviii + 824 pp. London

H: Hooker, William Jackson. 1821. Flora Scotica; or a description of Scottish plants, arranged both according to the artificial and natural methods. In two parts.
Part 2 (Acotyledons). 162 pp. London.

HFD: Hornemann, J. W., Editor. 1821. Icones plantarum sponte nascentium in regnis Daniae et Norvegiae, et in Ducatibus Slevici, Holsatiae et Oldenburg; ad illustrantum opus de iisdem plantis, Regio jussu exarandum, Florae Danicae. Fascicle 29, pls. 1681-1740 + accompanying text. Havniae.

HFL: Hooker, W. J. 1821 *in* Flora Londinensis: containing a history of the plants indigenous to Great Britain, illustrated by figures of the natural size. [2nd Edition] London. Vol. 4, fascicle 2: numbered plates plus accompanying text.

K: Krombholz, Julius Vincenz. 1821. Conspectus fungorum esculentorum, qui per decursum anni 1820 Pragae publice vendebantur. 40 pp. Pragae.

L: Latterrade, J. F. 1821. Flore Bordelaise ou description caractéristique des plantes qui croissent naturellement aux environs de Bordeaux, avec l'etymologie, le site, l'epoque de floraison, etc.; leurs propriétés et leurs principaux usages; précédée de notions élémentaires sur la botanique. Second edition. 516 pp. Bordeaux.

LD: Leman, *in* [Anonymous] "Plusieurs Professeurs du Jardin du Roi, et des principales Écoles de Paris." 1821. Dictionnaire des Sciences Naturelles, dans lesquel on traite méthodiquement des differéns êtres de la nature, considérés soit en eux-mêmes, d'aprés l'état actuel de nos connoissances, soit relativement a l'utilité qu'en peuvent retirer la médecine, l'agriculture, le commerce et les arts. Suivi d'une biographie des plus célèbres naturalistes. [Leman wrote all of the offerings on fungi in volumes 18-22 and these individual entries (all signed) are as follows:]

Vol. 18.	*Gemmularia*	p. 311
	Geoglossum	357-358
	Geotrichum	445
Vol. 19.	*Gomphus*	194
	Gonytrichum	209
Vol. 20.	*Gymnopus*	140
	Gymnosporangium	140-142
	Gyraria	179
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	Helicotrichum	461
	Helmisporium	495-497
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	Helvella	510-514
	Helycomyces	517

Vol. 21.	*Hericium*	52
	Hericius	52
	Hexagonia	143
	Himantia	161-166
	Hormiscium	430
Vol. 22.	*Hydnum*	91-97
	Hydrophora	261
	Hygromitra	305-306
	Hymenotheques	337
	Hyphomycetes	348
	Hypochnus	368-369
	Hypoderma	369-371
	Hypodermium	371
	Hypolepia	375
	Hyponervis	376
	Hypoxylées	384-385
	Hypoxylon	385-386
	Hysterium	399-402

MNA: Martius, C. P. 1821. Decas Plantarum Mycetoidearum, quas itinere Brasiliensi. Nova Acta Physico-Medica Acad. Caesarae Leopoldinae-Carolinae. Nat. Cur. 10(1): 505-512 + pl. xlvi.

M: Mérat, F. V. 1821. Nouvelle flore des environs de Paris. Second edition.
Vol. 1. iii + 292 pp. Paris.
Vol. 2. xiii + 468 pp. Paris.
[According to Rogers (1941) this appeared in the week of 9-15 June.]

N&B: Nocca, Dominus & Joannes Baptista Balbis. 1821. Flora Ticinensis seu enumerato plantarum quas in peregrinationibus multiplicibus plures per annos solertissime in Papiensi agro peractis observarunt, et collegerunt.
Vol. 2. xvi + 393 pp. + 39 corrigenda + pls. xi-xxvii. Ticini.

NNA: Nees v. Esenbeck, Th. Fr. L. 1821. Boleti fomentarii Pers. varietas singularis; etc. Nova Acta Physico-Medica Acad. Caesarae Leopoldinae-Carolinae. Nat. Cur. 10: 235-238.

P: Purton, T. 1821. An appendix to the Midland Flora; comprising also corrections and additions referring to the two former volumes: and occasional observations tending to elucidate the study of British fungi.
Vol. 3. xiv + 575 pp. London.

R: Roques, Joseph. 1821. Phytographie médicale ornée de figures coloriées de grandeur naturelle, ou l'on expose l'histoire des poisons tirés du régnes végétal, et les moyens de remédier a leurs effets déletéres, avec des observations sur les propriétés et les usages des plantes heroïques.
Vol. 1. xii + 304 pp. Paris.
Vol. 2. 328 pp. Paris.
[I have seen only the volumes at Kew, which are accompanied by numerous colored plates, in no apparent order, and miscellaneous notes. I have been furnished a copy of the appropriate portions by Dr. Derek Reid.]

Re: Re, Ioannis Francisci. [1821] Ad Floram Pedemontanam Appendix. 62 pp. Taurini.

RvS: Ritter v. Schrank. 1821. Betrachtungen über die Fungi subcutanei der Pflanzen. Flora o. Bot. Zeitung (Regensburg), no. 22: 337-349.

SA: St.-Amans, M. de 1821. Flore Agenaise ou description methodique des plantes observées dans le départment de Lot-et-Garonne et dans quelques parties des départements voisins. lxi + 632 pp. Agen.
[See Donk in Taxon 6: 253. 1957. for notes on the dates of appearance.]

SB: Svensk Botanik, utgiven af J. W. Palmstruck, och å nyo upplagd af G. J. Billberg. vol. 9: unnumbered pagination.

Sch: Schleicher, J. C. 1821. Catalogus hucusque absolutus omnium plantarum in Helvetia cis et transalpina sponte nascentium. Fourth edition. ii + 64 pp. Cambarii.

Spr: Sprengel, K. 1821. Neue Entdeckungen im ganzen Umfang de Pflanzenkunde, herausgegeben. Vol. 2. 363 pp. Leipzig.

Z: Zantedeschi, G. 1821. Continuazione della descrizione dei funghi della Provincia Bresciana del sig. Giovanni Zantedeschi Medico in Bovegno nella Valle Trompia. Giorn. Fisica, Chimica, Storia Naturale, Med. & Arti de Configliachi & Brugnatelli. Decade II, Vol. 4: 90-113; 307-319; 344-354.
[Xerox copies of appropriate pages were furnished me by Dr. G. Govi]

*The Pre-*1821 *Source Literature*

AdS: Abbildungen der Schwämme [C. F. Hoffmann, anonymously]
Erstes heft. 1790. taf. i-x. no location.
Zweytes heft. 1791. taf. xi-xx. no location.
Drittes heft. 1793. taf. xxi-xxx. no location.
[I have run literature through the copy at BPI]

A&S: Albertini, I. B. & L. D. de Schweinitz. 1805. Conspectus fungorum in Lusatiae superioris agro Niskiensi crescentium e methodo Persooniana. xxiv + 376 pp + 12 pls. Lipsiae.
[There is a microfiche edition available from IDC]

BEF: Batsch, A. J. G. C. 1783. Elenchus Fungorum. Accedunt icones LVII fungorum nonullorum agri jenensis, secudum naturam ab autore depictae, aeri incisae et vivis coloribus fucatae a I. S. Capieux. Halae. 184 pp + 12 pls.

BEFC 1: Batsch, A. J. G. C. 1786. Elenchus Fungorum Continuatio Prima. Describens CXXV species et varietates totidem iconibus LIX - CXXXIII repraesentatas. Halae. 280 pp + pls. 13-30.

BEFC 2: Batsch, A. J. G. C. 1789. Elenchus Fungorum. Continuatio Secunda. Describens XLIX species et varietates totidem iconibus CLXXXIV - CCXXXII repraesentatas. 164 pp + pls. 31-42. Halae.

BH: Bulliard, P. Histoire des champignons de la France, ou traité élémentaire, renfrement dans un ordee méthodique les decriptions et les figures des champignons qui croissent naturellement en France.
Tome I. Part 1. "1809" [1791 according to Rickett, North American Flora 1(1) xvi + 232.

Paris.
Tome 1. Part 2. "1809". [1791, according to Stafleu, 1967:67] pp. 233-368 + ix index + 173 pls. Paris
Tome II. Part 1. 1809. pp. 369-540. Paris.
Tome II. Part 2. 1812. pp. 541-684. Paris.
[According to Stafleu, Vol. 2 was issued in three parts: part 1: pp 373-508 + 108 pls; part 2: pp. 369-372, 509-540, by Bulliard and Ventenant; part 3: pp. 541-700 + 112 pls. edited and published by Ventenant. Most subsequent authors cite the plates only. I have seen copies at NY, BPI, and K, and have run the literature through the copy at BPI.]

Bolt.: Bolton, James. An history of fungusses, growing about Halifax. With forty-four copper plates; on which are engraved fifty-one species of agarics. Wherein their appearances in the different stages of growth are faithfully exhibited in about two hundred figures, copied with great care from the plants, when newly gathered and in a state of perfection. With a particular description of each species, in all its stages, from the first appearance to the utter decay of the plant; with time they are gathered; the soil and situation in which they grow; their duration; and the particular places mentioned, where all the new and rare species were found. The whole being a plain recital of facts, the results of more than twenty years observation.
Vol. 1. 1788. xvi + 44 pp + 44 pls. Halifax.
Vol. 2. 1788. (similar title) xvii-xxv + pp. 45-92 + pls. 45-92. Huddersfield.
Vol. 3. 1789. (similar title) xxvi-xxxii + pp. 93-182 + pls. 93-182. Huddersfield.

Bosc: Bosc, Louis 1811. Memoire sur quelques especes de champignons des parties meridionales de l'Amerique septentrionale. Mag. d. Ges. naturf. Freunde, Berlin V: 83.

CFL: Curtis, William. Flora Londinensis, or plates and descriptions of such plants as grow wild in the environs of London: with their places of growth, and times of flowering; their several names according to Linnaeus and other authors: with a particular description of each plant in Latin and English, to which are added, their several uses in medicine, agriculture, rural economy, and other arts.

Vol. I. Unpaged text accompanying numbered plates out of order. London.

[No fungi occur in this volume, for the system is that of Linnaeus.]

Vol. II. Unpaged text and numbered plates out of order. London.

[These rare volumes may be found at the Library of Congress, Washington. The beautiful plates of fungi are found at the rear of Vol. II, and then in no discernable order.]

DC 2: de Lamarck, J. and A. de Candolle. 1815. Flore francaise ou descriptions succinctes de toutes les plantes qui croissent naturellement en France, disposées selon une nouvelle méthode d'analyse, et précédées par un exposé des principe élémentaires de la botanique. Third Edition. "Augmentee du tome V, ou sixieme volume." Paris. Vol. 2. 600 pp.

DC 6: Candolle, A. P. de. 1815. Flore francaise, ... Vol. 6 ("Tome cinquieme, ou sixieme volume). Paris. 662 pp.
[A revision of a series begun by Lamarck, and so indexed in some libraries.]

DCM: De Candolle, Augustin Pyramus. 1815. Mémoires sur les Rhizoctones, nouveau genre de champignons qui attaquent les racines des plantes, et en particulier celle de la Luzerne cultivée. Mem. Mus., Paris II: 209.
1815. Mémoire sur le genre *Sclerotium*, et en particulier sur l'Ergot des céréales. Mem. Mus., Paris II: 401.
1817. Mémoire sur les champignons parasite, I. Mém. sur le genre *Xyloma*. mem. Mus., Paris III: 312.
1817. Mémoire sur les champignons parasite. II. Mem. sur les genres *Asteroma*, *Polystigma*, et *Stilospora*. Mem. Mus., Paris III: 328.
[I have not seen these references, and the citations are taken from Lindau and Sydow's *Thesaurus*.]

Dick.: Dickson, James. Fasciculi IV plantarum cryptogamicarum Brittanniae.
Fasc. I. 1785. 26 pp + 3 pls. London.

Fasc. II. 1790. 31 pp + 3 pls. London.
Fasc. III. 1793. 24 pp + 3 pls. London.
Fasc. IV. 1801. 28 pp + 3 pls. London.

EJG: Ehrenberg, C. G. 1820. Fungorum nova genera tria. Jährbucher der Gewächskunde. 1: 51-58 + pl.

FD: Icones plantarum sponte nascentium in regnis Daniae et Norvegiae et in Ducatibus Slevici, Holsatiae et Oldenburg: ad illustrandum opus de iisdem Plantis, Regio jussu exarandum, Florae Danicae. Havniae. [usually cited at "Flora Danica"]

Fasc.:
1: 1-60. 1761.
2: 61-120. 1763.
3: 121-180. 1764.
4: 181-240. 1765.
5: 241-300. 1766.
6: 301-360. 1767.
7: 361-420. 1768.
8: 421-480. 1769.
9: 481-540. 1770.
10: 541-600. 1771.
11: 601-660. 1775.
12: 661-720. 1777.
13: 721-780. 1778.
14: 781-840. 1780.
15: 841-900. 1782.
16: 901-960. 1787.
17: 961-1020. 1790.
18: 1021-1080. 1792.
19: 1081-1140. 1794.
20: 1141-1200. 1797.
21: 1201-1260. 1799.
22: 1261-1320. 1806.
23: 1321-1380. 1808.
24: 1381-1440. 1810.
25: 1441-1500. 1813.
26: 1501-1560. 1816.
27: 1561-1620. 1818.
28: 1621-1680. 1819.
29: 1681-1740. 1821.
(total: 51 fascs. + supplement, to 1880)

FNS: Fries, Elias Magnus. Novitiae florae Suecicae. Lundae.
Part I. 1814. 22 pp.
Part II. 1814. pp. 23-40.
Part III. 1817. pp. 41-50.
Part IV. 1817. pp. 51-60.
Part V. 1819. pp. 61-72.
[I have run literature through these parts at BPI. There are parts VI and VII at NY and Arnold Arboretum, Harvard Univ.]

FO 1: Fries, E. M. 1815. Observationes Mycologicae. Havniae. 230 pp. + pls. I-IV.
[Microfiche edition available from IDC]

FO 2: Fries, E. M. 1818. Observationes Mycologicae, praecipue ad illustrandam Floram Suecicam. Hafniae. 376 pp. + pls. V-VIII.
[Microfiche edition available from IDC]

HBR: Holmskjold, Theodoro. Beata ruris otia fungis Danicis.
Vol. 1. 1790. xxiv + 118 pp. Havniae.
[Kobbernes orden og forklaring. Ordo et explicatio inconum. 38 pp + 31 pls.]
Vol. 2. 1799. 70 pp + 42 pls. Havniae.
[I have used the copies at NY and BPI]

HDF: Hoffmann, Georg Franz. 1795. Deutschlands flora oder botanisches Taschenbuch. Zweyter teil. Cryptogamie. 200 pp + 14 pls. Erlangen.
[Copy at BPI]

HFA: Hudson [i], Gulielmi. 1778. Flora Anglica; exhibens plantas per regnum Brittaniae sponte crescentes, distributas secundum systema sexuale: cum differentiis specierum, synonymis auctorum, nominibus incolarum, solo locarum, tempore florendi, officinalibus pharmacopaeorum. Vol. 2: pp. 335-690. London.
[I have seen the copy at the U. S. Dept. Agriculture library at Beltsville, Md.]

Hoffm: Hoffmann, C. F. 1789. Nomenclator fungorum. Pars I. Agarici. viii + 256 pp + vi pls. Berolin.
____________ 1790. Nomenclator fungorum. Pars I. Agarici. Continuatio prima, indice locupletata 85 pp. Berolin.

HV: Hoffmann, Georg Franz. Vegetabilia cryptogamica.
Fasc. I. 1787. viii + 42 pp. + 8 pls.
Fasc. II. 1790. 34 pp + 8 pls.

LDC: de Lamarck, Jean Baptiste Antoine Pierre Monnet and A. P. De Candolle. 1808.
Synopsis plantarum in Flora Gallica descriptionarum. Paris xxiv + 432 pp.
[Copy at NY]

LM: Link, Heinrich Friedrich. 1809. Observationes in ordines plantarum naturales. Dissertatio I, complectans Anandrarum ordines epiphytas, Mucedines, Gastromycos et fungos. Mag. d. Ges. naturf. Freunde, Berlin III: 3-42.

__________ 1816. Observationes in ordines plantarum naturales. Dissertatio II, sistens nuperas de Mucedinum et Gastromycorum ordinibus observationes. Mag. d. Ges. naturf. Freunde, Berlin VII: 25-45.

PCC: Persoon, C. H. 1797. Commentatio de fungis clavaeformibus sistens specierum huc usque notarum descriptiones cum differentiis specifics nec non auctorum synonymis. Lipsiae 124 pp + 4 pls.
[Microfiche edition: IDC]

PCS: Persoon, C. H. 1800. Commentarius D. Iac. Christ. Schaefferi quondam eccles. evangel. Ratisbon. pastoris et superintendentis, Fungorum Bavariae Indigenorum, icones pictas differentiis specificis, synonymis et observationibus selectis illustrans. Erlangae. 130 pp + index.
[Microfiche edition: IDC]

PD: Persoon, C. H. 1797. Tentamen dispositionis methodicae fungorum, in classes ordines genera et familias, cum supplemento adjecto. Lipsiae. iv + 76 pp.
[Microfiche edition: IDC]

POM 1: Persoon, C. H. 1796. Observationes Mycologicae seu descriptiones tam novorum, quam notabilium fungorum exhibitae. Pars prima. Lipsiae. 115 p, 6 pls.
[Microfiche edition: IDC]

POM 2: Persoon, C. H. 1799. Observationes Mycologicae ... pars secunda. Lipsiae, 105 pp, 6 pls.
[Microfiche edition: IDC]

PIC: Persoon, C. H. 1798-1800. Icones et descriptiones fungorum minus cognitorum. Fasciculus I. Lipsiae. 28 pp + 7 pls. Fasc. II. pp. 29-60 + pls. 8-12.
[Microfiche edition: IDC]

NS: Nees von Esenbeck, E. G. 1817. Das system der Pilze und Schwämme. xxxviii + 329 pp + "Ueberblick des Enstems der Pilze und Schwämme - zur erklärung

der Kupfertafeln." 86 pp.

Roth: Roth, Albrecht Wilhelm. Tentamen Florae Germanicae.
Vol. I. 1788. xvi + 560 pp. Lipsiae.
Vol. II. 1789. ii + 624 pp. Lipsiae.
Vol. II, part 2. 1793. 593 pp. Lipsiae.
Vol. III. 1800. 578 pp. Lipsiae.

Schr.: Schrader, Heinrich Adolph. 1794. Spicilegium florae Germanicae. Hannoverae. 194 pp + 4 pls.

Scop.: Scopoli, Joannis Antonii. 1772. Flora Carniolica exhibens plantas Carnioliae indigenas et distributas in classes, genera, species, varietates, ordine Linnaeano. Second Edition.
Vol. 2. 496 pp + index.
[Copies at NY, BPI]

Sib.: Sibthorp, John. 1794. Flora Oxoniensis, exhibens plantas in agro Oxoniensi sponte crescentes, secundum systema sexuale distributas. xxiv + 422 pp. Oxonii.
[Copy at Library of Congress]
Swartz, Olaf. Flora Indiae occidentalis aucta atque illustrata, sive descriptiones plantarum in Prodrom rescentitarum.
Vol. I. 1797. viii + 460 pp + 15 pls. Erlangen.
Vol. II. 1800. pp 641-1230 + pls. 16-29. Erlangen.
Vol. III. 1806. pp 1231-2018 + index Erlangen.

TM: Tode, Henrico Iulio. Fungi Mecklenburgensis selecti.
Fasc. I. 1790. viii + 47 + index + vii pls. Luneburgi.
Fasc. II. 1891. viii + 64 + index + xvii pls. Luneburgi.

Willd.: Willdenow, Caroli Ludovici. 1787. Florae Berolinensis Prodromus. xvi + 439 pp + vii pls. Berolin.

With.: Withering, William. A botanical arrangement of all the vegetables naturally growing in Great Britain, with descriptions of the genera and species, etc.

Third Edition. Vol. 4. 1796. 418 pp + 3 pls.

[I have not seen this edition.]

-- A --

abietina (Clavaria) Fr: 469; Schl: 56 ← [PD: 37]
abietina (Thelephora) Fr: 442 ← [FO 2: 274 (Stereum) ← PS: 573 (Thelephora)]
abietinum (Hericium) Schl: 57 ← ["Schrad. p. 181"]
abietinum (Daedalea) Fr: 334 ← [BH: 379, pl. 442 fig. 2 (Agaricus)]
abietinum (Hysterium) Schl: 58 ← [POM 1: 31]
abietinus (Agaricus) Re: 52; M: 50 ← [BH: 379, pl. 442 f. 2]
abietinus (Boletus) Schl: 56; P: 242; G: 643 ← [PS: 541 ← "Dick. 3: 9"]
abietinus (Polyporus) Fr: 370 ← [PS: 541 (Boletus) ← "Dick. 3: 9"]
acnathoides (Boletus) M: 43 ← [BH: 337, pl. 486]
acariforme ("Erysibe" Erysiphe) G: 590 ← [S: f. pl. 146 (Lycoperdon)] :Fr 3: 210 (Institale)
acaulis (Helvella) M: 29 ← [POM 2: 20]
accerinum (Erineum) N&B: 368 ← [PD: 43]
acerbus (Agaricus) Fr: 49; M: 70 ← [BH: 603, pl. 571 f. 2]
acerina (Rubigo) G: 556 ← [PD: 43]
acerina (Thelephora) Fr: 453 ← [PS: 581 ← POM 1: 37 (Corticium)]
acerinum (Dematium) Schl: 57 (?sp. nov.)
acerinum (Erineum) FBR: 41, P: 313, H: 34, Schl: 57, M: 16, SA: 529 ← [PD: 43]
acerinum (Erysiphe) Schl: 57 ← [(?orthographic variant of "aceris")]
acerinum (Rhytisma) FSS no. 207 ← [PD: 5, not 52 (Xyloma)] : Fr 2: 569
acerinum (Xyloma) H: 9, Schl: 60, Spr: 279 (?as Rhytisma), RvS: 345, N&B: 301, M: 149, SA: 517 ← [PD: 5, not 52]
acerinum (Xyloma) G: 545 ← [NS 1: 25]
aceris (Erysiphe) M: 131, SA: 615 ← [DC 6: 104]
acerosus (Agaricus) Fr: 191, not 101 (sp. nov.)
acervatus (Agaricus) Fr: 122 (sp. nov.)
acetabulum (Peziza) SA: 533, M: 24 ← [LSP: 1181] :Fr 2: 44
acharii (Actidium) LD 22: 401 ← [FOM 1: 190]

achilleae (Xyloma) Schl: 60 (?sp. nov.) :Fr 3: 199 (Labrella)
aciculare (Helotium) G: 660, SA: 530 ← [PS: 677 (Helotium) ← POM 2: 20 (Leotia)]
:Fr 2: 156
acris (Agaricus) Fr: 65 ← [Bolt. t. 60]
acris (Agaricus) P: 397, N&B: 326, R: 30 ← [Bolt. t. 60 ← "Withering"]
acris (Agaricus) SA: 563, M: 53, R: 27 ← [BH: 500, pl. 200]
acris (Agaricus lactifluus) Z: 316 ← [Bolt. t. 60]
acris (Lactarius) G: 625 ← [Bolt. t. 60]
aculeiformis (Clavaria) SA: 539, M: 31 ← [BH: 214, pl. 463 f. 4]
acuminata (Sphaeria) G: 530 ← [S: f. pl. 394 f. 3 (Sphaeria fusco marginata [var.]______)]
:Fr. 2: 506
acuta (Clavaria) Fr: 485, G: 657 ← [S: f. pl. 333]
acuta (Sphaeria) P: 489, G: 530 ← ["Hoffm. 1: 22"] Fr 2: 506.
acutus (Agaricus) Fr: 233 ← [PS: 316]
adhaerens (Agaricus) Fr: 96 ← [A&S: 186, not 187]
adhaesivus (Agaricus) P: 187 ← [With. 4: 160]
adhaesivus (Agaricus adhaerens [var.]) Fr: 96 ← [With. 4: 160]
adiposus (Agaricus) Fr: 242 ← [BEFC 1: 147]
adonis (Agaricus) Fr: 152, M: 64 ← [BH: 445, pl. 560 f. 2]
adonis (Mycena) G: 620 ← [BH: 445, pl. 560 f. 2 (Agaricus)]
adstringens (Agaricus) Fr: 195 ← [PS: 350]
adusta (Omphalia) G: 614 ← [PS: 459 (Agaricus)]
adustus (Agaricus) Fr: 60, P: 400 ← [PS: 459, var. α only]
adustus (Agaricus omphalia) Z: 349 (?nom. nov.)
adustus (Polyporus) Fr: 363 ← [Willd: 392 (Boletus)]
aecidioides (Stictus) G: 663 ← [NS 1: 256 (Peziza)]
aegarophila (Conferva) P: 175 ← [LSpPl: 1637 "aegagropila"]
aegopodii (Sphaeria) H: 8 ← [POM 1: 17]: Fr 2:526
aereus (Boletus) Fr: 393, M: 44, SA: 533, R: 23 ← [BH: 321, pl. 385]
aeruginea (Agaricus plumbeus var.) M: 54-55 ← ["Lamarck, Dict. 1: 105"]

aeruginosa (Peziza) Schl: 58 ← [PS: 663 ← POM 1: 27] : Fr 2: 130
aeruginosa (Helvella) P: 258 ← [PS: 617]
aeruginosa (Pratella) G: 626 ← [CFL 2: pl. 309]
aeruginosum (Fusidium) G: 544 ← ["LM 3: 8"]
aeruginosum (Helotium) G: 661 ← [PS: 617 ← "FD pl. 534, f. 2" (Helvella)]
aeruginosus (Agaricus) Fr: 286, P: 414 ← [CFL 2: pl. 309]
aeruginosus (Agaricus pratella) Z: 308 ← [CFL 2: pl. 309]
aestuans (Agaricus) Fr: 47 (sp. nov.)
affricatus (Agaricus) Fr: 169, not 162 (sp. nov.)
agardhii (Hydnum) Fr: 418 ← [FNS: 40, not 39]
agariciformis (Helvella) P: 451 ← [Bolt: 98]
agariciformis (Helotium) M: 19, SA: 530, LD20: 508 ← [Bolt: 98]
agariciformis (Xylaria) G: 511 ← [Bolt: 130 (Sphaeria)]
agaricoides (Morchella) M: 90 ← [DC 2: 212]
aggregatum (Dichosporium) G: 569 ← [NS 1: 105] : Fr 3: 219
aggregatus (Agaricus gymnopus) Z: 98 ← ["Sch. pl. 305"]
alba (Agaricus pudicus var.) M: 86 ← [BH: 635, pl. 597]
alba (Amanita) R: 46 (sp. nov.)
alba (Auricularia papyrina var.) M: 35 ← [BH: 279, pl. 402]
alba (Clavaria coralloides var.) M: 32 ← [BH: 201, pl. 496, fs. L, M, P]
alba (Helvella elastica var.) M: 29 ← [BH: 300, pl. 242]
alba (Morchella esculenta var.) M: 90 ← [BH: 274, pl. 218 (Phallus)]
alba (Peziza callosa var.) M: 21 ← [BH: 252, pl. 416 f. 1]
alba (Peziza fructigena var.) M: 23 ← [BH: 236, pl. 228, fs, C, D]
alba (Peziza papillaris var.) M: 22 ← [BH: 244, pl. 467, f. 1]
alba (Ramaria coralloides [var.]) G: 655 (var. nov.)
alba (Tremella cerebrina var.) M: 28 ← [BH: 222, pl. 386, f. A]
albellus (Agaricus) L: 474 (sp. nov.)
albellus (Agaricus) M: 70, R: 35 ← [Sch. 4: 34, pl. 78]
albertini (Agaricus) Fr: 179 (nom. nov.)

albicans (Sphaeria) M: 144 ← [POM 1: 71]
albicans (Xylaria) G: 511 (nom. nov.)
albida (Daedalea) P: 253 ← [Sch. 4: 84, pl. 124 (Boletus)]
albida (Daedalea) Fr: 338 ← [FO 1: 107]
albida (Gyraria) G: 593 ← [HFA: 565, as alga]
albida (Tremella) P: 512, H: 31 ← [HFA: 565, as alga]
albidus (Albatrellus) G: 645 ← [PS: 515 (Boletus)]
albidus (Cantharellus) Fr: 319 (nom. nov.)
albipes (Agaricus gnaphaliocephalus var.) M: 69 (var. nov., not BH)
albisporus (Boletus aereus [var.]) SA: 553 (var. nov., not BH)
albobrunneus (Agaricus) Fr: 37 ← [FO 2: 118 "albo-brunneus" ← PS: 293
"albobrunneus" ← PCS: 15 "brunneus"]
albo-grysea (Peziza papillaris var.) M: 22 (var. nov., not BH)
alboviolaceus (Agaricus) Fr: 218, not 213 ← [PS: 286 "albo-violaceus"]
album (Erysiphe) Schl: 57 ← [FO 1: 207]
album (Sclerotium) SA: 617 ← [DC 6: 112]
album (Tuber) K: 39, SA: 619, G: 592 ← [BH: 80, pl. 404]: Fr 2: 293 (Rhizopogon)
albus (Agaricus) Fr: 53 ← [Sch 4: 68, pl. 256]
albus (Agaricus gymnopus) Z: 90 ← [PS: 363 (Agaricus ______)]
albus (Agaricus pyxidatus var.) M: 68 (var. nov., not BH)
albus (Agaricus grammopodius var.) M: 71 (var. nov., not BH)
albus (Agaricus pectinaceus var.) M. 52 (var. nov., not BH)
albus (Gymnopus) G: 610 ← [PS: 363 (Agaricus)]
albus (Agaricus adonis var.) M: 64 (var. nov., not BH)
alcalinus (Agaricus) Fr: 142 ← [FO 2: 153]
alchemillae (Xyloma) Schl: 60 (sp. nov.)
aleuriatus (Agaricus) Fr: 238 ← [FO 1: 49]
algidus (Agaricus) Fr: 190 (nom. nov.)
alliaceus (Agaricus) Fr: 140 ← ["Jacquin, obs., p. 100"]
alliaceus (Agaricus) P: 208, H: 23 ← [With III, 4: 277]

alliaceus (Agaricus) M: 62, R: 34 ← [BH: 551, pl. 153]
alliatus (Agaricus gymnopus) Z: 92 (nom. nov.)
allochroa (Botrytis) G: 553 ← ["LM 3: 16"] : Fr 3: 402
alnea (Peziza) Schl: 58 ← [PS: 673]
alnea (Thelephora) Fr: 446 (nom. nov.)
alnea (Rubigo) G: 556 ← [PS: 701 (Erineum)]
alneum (Erineum) Re: 55, H: 34, M: 17, Schl: 57, P: 314 † ← [PS: 701]
alneum (Erysiphe) Schl: 57 ← [?"Fr"]
alneum (Xyloma) M: 149, H: 9, Schl: 60, P: 318 ← [PS: 108] : Fr 2: 564 (Dothidia)
alneus (Agaricus) L: 472, H: 25, M: 50, N&B: 331, Schl: 56 ← [LSP: 1176]
alneus (Agaricus) SA: 559 ← [Scop 2: 460]
alneus (Apus) G: 617 ← [Hoffm 1: 253 (Agaricus)]
alneus (Boletus) G: 640 ← [POM 1: 86]
alni (Erysiphe) Re: 55, M: 131, G: 589 "Erysibe" ← ["LDC: 57"]
alnicola (Agaricus) Fr: 250 (nom. nov.)
alternatum (Acremonium) G: 550 ← ["LM 3: 15"] : Fr 3: 425
altum (Hormiscium) LD 21: 430 ← ["Ehrenb. Sylv. Mycol. p. 10"]
aluta (Byssus) M: 12 ← [PD: 43]
alutacea (Scodellina) G: 668 ← [POM 2: 78 (Peziza)]
alutacea (Xylaria) G: 511 ← [PCC: 12(Sphaeria)] : Fr 2: 325 (Sphaeria)
alutaceum (Hydnum) Fr: 417 (sp. nov.)
alutaceus (Agaricus) Fr: 55 ← [PS: 441 (Agaricus russula ______) ← POM 1: 101
(Russula esculenta var.)]
alutaceus (Polyporus) Fr: 360 (sp. nov.)
alveolaris (Cantharellus) Fr: 322 ← [DC 6: 43 (Merulius)]
alveolaris (Polyporus) Fr: 343 ← ["Bosc: 84"]
amadelphus (Agaricus) Fr: 135, M: 67 ← [BH: 537, pl. 550, f. 3]
amara (Helvella) LD20: 513 ← ["Loureiro, Cochinchine, p. 695"]
amarus (Agaricus) Fr: 87 (sp. nov.)
amarus (Agaricus) M: 60, SA: 569, N&B: 323 R: 33 ← [BH: 478, pl. 30]

ambiens (Circinostoma) G: 521 ← [PS: 44 (Sphaeria)] : Fr 2: 403 (Sphaeria)
amboinensis (Polyporus) Fr: 354 (sp. nov.)
ambustus (Agaricus) "Fr: 158" (not located)
amelanchier (Sphaeria) Schl: 59 (sp. nov.)
amethistea (Clavaria) SA: 540, N&B: 345 ← [BH: 200, pl. 496, f. 2 "amethystea" ← HBR: 110 "amethystina" (Ramaria)]
amethystaeus (Agaricus) N&B: 330 ← [HFA: 612 "amethystina"]
amethystea (Clavaria) M: 32 ← [BH: 200, pl. 496, f. 2 "amethystea" ← HBR: 110 "amethystina" (Ramaria)]
amethystea (Omphalia) G: 614 ← [HFA: 612 "amethystina" (Agaricus)]
amethystea (Ramaria) G: 656 ← [PS: 590 "amathystea" (Clavaria) ← HBR: 110 "amethystina" (Ramaria)]
amethystea (Tremella) M: 28, SA: 536 ← [BH: 229, pl. 499, f. 5]
amethysteus (Agaricus) M: 68 ← [HFA: 612 "amethystina"]
amethysteus (Agaricus omphalia) Z: 347 ← [HFA: 612 "amethystina" (Agaricus______)]
amethystina (Clavaria) Fr: 472 ← [BH: 200, pl. 496, f. 2 "amethystea" ← HBR: 110 "amethystina" (Ramaria)]
amethystinus (Agaricus) H: 20, P: 399 ← [HFA: 612]
amictus (Agaricus) Fr: 141 "amiotus" of index ← ["A&S no. 552"]
amorpha (Peziza) P: 265 †, Schl: 58 ← [PS: 657] : Fr El 1: 183
amorphus (Polyporus) Fr: 364 ← [FO 2: 258]
amphibolia (Thelephora, as "T. L [ejostroma] ______") Fr: 454 ← [FO 1: 151, not 150]
amplus (Agaricus) Fr: 95 ← [PS: 359]
andromedae (Xyloma, not Rhytisma) Spr: 279 ← [PS: 104] : Fr 2: 567
andromedae (Xyloma) Schl: 60 ← [PS: 104]
androsaceus (Agaricus) Fr: 137, Schl: 56, M: 61, SA: 571 ← [LSP:1175]
androsaceus (Agaricus omphalia) Z: 345 ← [LSP: 1175]
androsaceus (Merulius) P: 390, H: 25 ← [LSP: 1175 (Agaricus)]
anethi (Sphaeria) FSS no. 193 ← [POM 1: 67] : Fr 2: 429
angulare (Xyloma) P: 317 (sp. nov.)

angustata (Clavaria) Fr: 481 ← [PCC: 72]
angustata (Daedalea) Fr: 338, G: 639 ← [S: p. f. pl. 193]
angustatum (Hysterium) M: 153, Schl: 58, H: 8, P: 320, G: 510 ← [PS: 99] : Fr 2: 580
angustus (Agaricus) Fr: 195 ← [PS: 345]
annosus (Polyporus) Fr: 373 (sp. nov.)
annularius (Agaricus) SA: 586, M: 85, N&B: 310, R: 39 ← [BH: 626, pl. 377]
annularius (Boletus) L: 471, M: 46 ← [BH: 316, pl. 332]
annulatus (Thamnomyces) Ehren: 519 ← [?]
annulatus (Boletus) K: 22 ← [PS: 503 "annulatus" ← PCS: 45 "annularius" ← BH: 316 "annularius"]
annullarius (Agaricus) L: 475 ← [BH: 626, pl. 377 "annularius"]
anomala (Clavaria) Fr: 480 (nom. nov.)
anomalus (Agaricus) Fr: 220 as "A. anomalus α proteus" (nom. nov.)
antennaeformis (Monilia) G: 557 ← ["HDF: t. 13, f. 4"]
anthocephala (Clavaria) P: 474 ← [BH: 197, pl. 452 ← "Relh. no. 1276"]
anthocephala (Clavaria) M: 33 ← [BH: 197, pl. 452]
apalus (Agaricus) Fr: 265, not. 268 ← [FO 2: 142]
apiculata (Clavaria) Fr: 470 (nom. nov.)
apocyni (Sclerotium) Schl: 59 (sp. nov.)
appendiculatus (Agaricus) SA: 570, N&B: 324, P: 230 ← [BH: 442, pl. 392]
appendiculatus (Agaricus) M: 60 ← ["Sch. pl. 237"]
appendiculatus (Agaricus pratella) Z: 309 ← [BH: 442, pl. 392]
applanatus (Boletus) G: 642 ← [?PS: 536 (B. fomentarius [var.]) ← ?POM 2: 2]
applicatus (Agaricus) Fr: 192, P: 239, Schl: 56 ← [BEF: 171]
applicatus (Resupinatus) G: 617 ← [BEF: 171 (Agaricus)]
apum (Xylaria) G: 511 (sp. nov.)
aquatica (Peziza) M: 20 ← ["DC Dict. Encycl. 5: 216"]
aquifolii (Phacidium) Schl: 58 ← [?K]
aquifolii (Xyloma) SA: 518 ← [DC 6: 159]
aquilegiae (Erysiphe) M: 132 ← [DC 6: 105]

aquilus (Agaricus) Fr: 208 (sp. nov.)
aquosus (Agaricus) Fr: 125, SA: 569, P: 232, M: 59 ← [BH: pl. 17, not BH: 470]
araneosa (Peziza) SA: 531, M: 21, P: 265, N&B: 350 ← [BH: 264, pl. 280] : Fr 2:69
araneosa (Sphaeria) G: 526 ← [PID: 24] : Fr. 2: 447, not 477
araneosus (Agaricus) P: 204 (nom. nov.), N&B: 311 (nom. nov.) ← [BH: pl. 598 f. 2B †]
araneosus (Agaricus) M: 82 ← [BH: pl. 250 "araneosus violaceus" ← ?Linn.]
arborea (Tremella) H: 31, P: 511 ← [HFA: 563, as alga]
arboreus (Boletus) P: 245 ← [S: p. f. pl. 346]
arbuti (Astoma) G: 525 ← [S: p. f. pl. 370, f. 6 (Sphaeria minutissima [var.])] : non Fr.
arcticum (Tryblidium) Spr: 310 ← [?Ehrenberg]
arcuatus (Agaricus) Fr: 109, not 103, M: 73, SA: 577 ← [BH: 595, pl. 443]
arcuatus (Mucor) MNA: 505 (sp. nov.)
arcularius (Polyporus) Fr: 342, "P. fav [olus]______" ← [BEF: 97]
ardenia (Clavaria) Fr: 478 ← [S: p. f. pl. 215]
ardeniae (Clavaria) G: 657 ← [S: p. f. pl. 215, "ardenia"]
ardosiacea (Peziza callosa var.) M: 21 ← [BH: 252, pl. 416, f. 1]
ardosiacus (Agaricus) Fr: 198, M: 66 ← [BH: 472, pl. 348]
argematus (Agaricus) Fr: 75 ← [FO 2: 190]
argentatus (Agaricus) Fr: 218 ← [PS: 286]
argentea (Byssus parietina var.) M: 11 (nom. nov.)
argillacea (Clavaria) Fr: 482 ← [PCC: 74]
argillacea (Peziza) G: 666 ← [S: p. f. pl. 148] : Fr 2: 66
argutum (Hydnum) Fr: 424 (sp. nov.)
argyraceus (Agaricus) SA: 580, M: 78, N&B: 316 ← [BH: 584, pl. 423]
armeniacus (Agaricus) Fr: 234 ← [Sch 4: 35, pl. 81]
armillatus (Agaricus) Fr: 214 (nom. nov.)
aromaticus (Agaricus) Fr: 35 ← [S: p. f. pl. 144]
artemisiae (Xyloma) FSS no. 219 (sp. nov.) : Fr 2: 600
articulatum (Erineum) M: 17 ← [DC 2: 188 "arriculatum" ← PD: 41]

artocreas (Sphaeria) FSS no. 151 ← ["Tode 2: 77"] : Fr 2: 523
arundinacea (Peripherostoma) G: 515 ← [S: p. f. pl. 336 (Sphaeria)]
arundinacea (Sphaeria) P: 287 ← [S: p. f. pl. 336] : Fr 2: 429
arundinaceum (Hypoderma) M: 152, G: 509, SA: 516, LD 22: 370 ← [DC 2: 305]
arundinaceum (Hysterium) Schl: 58 ← [DC 2: 305 (Hypoderma)] : Fr 2: 590
arundinaceum (Xyloma) M: 150 ← [DC 6: 162] : Fr El 2: 112 (Eustegia)
arundinaceus (Agaricus) SA: 571, M: 62, N&B: 314 ← [BH: 458, pl. 403]
arundinis (Sphaeria) FSS no. 153 (sp. nov.): Fr 2: 510
arvalis (Agaricus) Fr: 263 (sp. nov.)
arvensis (Agaricus edulis var.) M: 61 ← [Sch 4: 73, pl. 310 (Agaricus ______)]
asemus (Agaricus) Fr: 121 ← [FO 2: 125 "A. butyraceus var. ______"]
asper (Agaricus) Fr: 18, not 13, N&B: 308 ← [AbS 3]
aspera (Amanita) G: 600, R: 40 ← [AbS 3]
aspideus (Agaricus) Fr: 63 ← [FO 2: 189]
asprellus (Agaricus) Fr: 208 (sp. nov.)
asserculorum (Daedalea) Schl: 57 ← [?Pers.]
asterosperma (Stilbospora) G: 545 ← ["Hoffm. 2: pl. 13, f. 3"] : Fr 3: 448
asterospora (Stilbospora) M: 147 ← [HDF: p. f. pl. 13]
astragali (Erysiphe) M: 132 ← [DC 6: 105]
astragalinus (Agaricus) Fr: 251, not 25 (sp. nov.)
astroideus (Agaricus) Fr: 312 "A. copr[inus] ______" ← [BH: 413 (Agaricus ______)]
atramentarius (Agaricus) SA: 566, M: 56, N&B: 319 ← [BH: 413, pl. 164]
atrata (Octospora) G: 667 ← [PS: 669 (Peziza)] : Fr 2: 148 (Peziza)
atrata (Thelephora) Fr: 437 ← ["Swartz III: 1933"]
atratum (Sclerotium) SA: 617 ← ["DCM 2: 414"] : Fr 2: 251
atratus (Agaricus) Fr: 168 ← [FO 2: 215 "utratus"]
atro-alba (Mycena) G: 619 ← [Bolt: 137 (Agaricus)]
atroalbus (Agaricus) Fr: 141 "atro-albus" of index ← [Bolt: 137 "atro-albus"]
atro-albus (Crepidopus ostreatus [var.]) G: 616 (var. nov.)
atrocaeruleus (Agaricus) Fr: 190 "atro-caeruleus" of index ← [FO 1: 95 "atro-caeruleus"]

atrocyaneus (Agaricus) Fr: 147 ← [BEFC 1: 101]
atropuncta (Cortinaria viscida [var.]) G: 629 ("var. nov.")
atropunctus (Agaricus) Fr: 195 ← [PS: 353]
atropurpureum (Geoglossum) Fr: 490, G: 658 ← [BEF: 133 (Clavaria)]
atro-rufa (Mycena) G: 620 ← [Bolt: 51, not 52 (Agaricus)]
atrotomentosus (Agaricus) Fr: 272 ← [BEF: 89]
atrovirens (Agaricus) Fr: 43 ← [PS: 319]
attenuata (Monilia) Schl: 58 ← [?Pers., ?orthographic variant of antennata]
aucupariae (Hysterium) Schl: 58 ← [?Pers.]
aueri (Agaricus) Fr: 134 ← ["Sadl." (?Nees)]
aurantia (Aegerita) M: 15 ← [BH: 103, pl. 504, f. 5]
aurantia (Egerita) SA: 528 ← [BH: 103, pl. 504, f. 5]
aurantia (Peziza) H: 33 ← ["FD pl. 657"] : Fr 2: 49
aurantius (Boletus) LD 20: 181 ← [BH: 320, pl. 236 "aurantiacus"]
aurantiaca (Amanita) G: 599 ← [PS: 252 (Amanita) ← BH: 666 (Agaricus)]
aurantiaca (Byssus) SA: 526, M: 12 ← ["LDC: 524"]
aurantiaca (Clavaria) Fr: 482 ← [POM 1: 32 "aurantia"]
aurantiaca (Himantia) LD 21: 165 ← ["LDC: 524" (Byssus)]
aurantiaca (Scodellina) G: 668 ← ["FD pl. 657" (Peziza)]
aurantiaca (Sphaeria) G: 526 ← [PIC 2: 45 "aurantia"] : Fr 2: 440
aurantiaca (Thelephora) Fr: 445 "aurantia" ← [PS: 576 (Thelephora) ← PD: 31, not 21 (Corticium)]
aurantiacum (Hydnum) Fr: 403 ← [FO 1: 131 (______ ______) ← BEFC 2: 103 (H. suberosum var. ______)]
aurantiacum (Leccinum) G: 646 ← [BH: 320, pl. 236 (Boletus)]
aurantiacus (Agaricus) Fr: 68 (nom. nov.)
aurantiacus (Agaricus) L: 476, M: 88, N&B: 306, SA: 588 ← [BH: 666, pl. 120]
aurantiacus (Boletus) H: 26, P: 436, N&B: 334, SA: 555, M: 46 R: 23 ← [BH: 320, pl. 236]
aurantiacus (Boletus aurantiacus var.) M: 46 ← [BH: 320, pl. 236 (Boletus ______)]

aurantiacus (Lactarius) G: 624 ← [PS: 432 (Agar. lactifluus testaceus var. ______)]
aurantiacus (Merulius) G: 636, R: 53 ← ["Murr. Syst. veg. 14: 975"]
aurantiomarginatus (Agaricus) Fr: 113 (nom. nov.)
aurantius (Agaricus) Fr: 39 ← [Sch 4: 18, pl. 37]
aurantius (Agaricus) P: 415, H: 22 ← [CFL: 308]
aurea (Byssus) SA: 526, L: 466, M: 12 ← [LSpPl 2: 1638]
aurea (Daedalea) Fr: 339 (nom. nov.)
aurea (Helvella) H: 31 ← ["FD: pl. 534"]
aurea (Lepiota) G: 603 ← [BH: pl. 92, not p. 626 (Agaricus)]
aurea (Peziza) P: 464 ← ["Relh. ed. alt. no. 1244"] : non Fr.
aureum (Erineum) M: 17 ← [PS: 700]
aureum (Helotium) LD 20: 509 ← [PS: 678]
aureum (Sporotrichum) G: 551 ← ["LM 3: 13"] : Fr 3: 418
aureus (Hypochnus) LD 22: 368 ← [FOM 2: 281]
aureus (Mucor) MNA: 506 (sp. nov.)
aureus (Agaricus) Fr: 241, P: 194, SA: 586, M: 85, N&B: 310 ← [BH: pl. 92, not p. 626]
auricula (Agaricus) Fr: 85 ← [DC 6: 48, not Duby]
auricula (Peziza) L: 468, M: 26 ← [LSP: 1157 (Tremella) as alga]
auricula (Tremella) H: 32 ← [LSP: 1157, as alga]
auricula judae (Peziza) SA: 534 † ← [LSP: 1157 (Tremella) "auricula," as alga] : Fr 2: 221
auricula judae (Tremella) Schl: 60, N&B: 347 † ← [LSP: 1157, "auricula," as alga]
auricularis (Gyraria) G: 594, LD 22: 306 ("auricularia") ← [LSP: 1157 (Tremella),
"auricula," as alga]
auriscalpium (Hydnum) Fr: 406, P: 449, H: 28, M: 38, LD 22: 94 ← [LSP: 1178]
aurivella (Lepiota squarrosa var.) G: 602 ← [BEFC 1: 153 (Agaricus ______)]
aurivellus (Agaricus) Fr: 242 ← [BEFC 1: 153]
avellana (Thelephora) Fr: 442 (sp. nov.)
azonites (Agaricus) SA: 564, M: 54 ← [BH: 497, pl. 559, f. 1]

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badia (Scodellina) G: 669 ← [POM 2: 78 (Peziza)] : Fr 2: 46
badia (Grifola) G: 644 ← [PS: 523 (Boletus)]
badipus (Gymnopus) G: 605 ← [PS: 318 (Agaricus)]
badium (Sporotrichum) G: 551 ← ["LM 3: 12"]
badius (Boletus castaneus var.) Fr: 392 (Boletus ______ of index) (var. nov.)
barbajobi (Hydnum) M: 37 ← "With. III 4: 337" ← [BH: 303, pl. 481, f. 2 "barba jovis"]
barba jobi (Hydnum) SA: 545 ← [BH: 303, pl. 481, f. 2 "barba jovis"]
barba jovis (Hydnum) Fr: 421 ← [BH: 303, pl. 481, f. 2]
barbatum (Exormatostoma) G: 523 ← ["Pers., Ann. Bot. 11: 24" (Sphaeria)] : Fr 2: 514
(Sphaeria)
barbatus (Agaricus) Fr: 217 ← [BEF: 39]
battarae (Agaricus) Fr: 175 (nom. nov.)
bellus (Agaricus) Fr: 107 ← [PS: 452]
berberidis (Cucurbitaria) G: 519 ← [PD: 3 (Sphaeria)]
berberidis ("Erysibe," Erysiphe) G: 590 ← [DC 2: 275]
berberidis (Erysiphe) M: 133 ← [DC 2: 275]
berberidis (Hysterium) Schl: 58 ← [?Pers.]
berberidis (Sphaeria) SA: 523, M: 143 ← [PD: 3] : Fr 2: 415
bertieri (Agaricus) Fr: 175 (nom. nov.)
betulae (Erineum) Schl: 57 ← [?Pers.]
betulae (Erysiphe) M: 133 ← [DC 6: 107]
betulina (Daedalea) Fr: 333 ← ["Agar[dh]" ← LSP: 1176]
betulinum (Erineum) H: 34 ← [A&S: 370, not PS: 15]
betulinum (Xyloma) SA: 518, M: 149 ← [A&S: 63 (Xyloma acerinum [var.])]
betulinus (Agaricus) P: 435, M: 24 † ← [LSpPl: 1645]
betulinus (Boletus) M: 44 ← [BH: 348, pl. 312]
betulinus (Boletus) G: 641 ← ["Gmelin. Syst. Nat. 2: 1436"]

betulinus (Daedalea P: 247 ← [LSpPl: 1645 (Agaricus)]

betulinus (Polyporus) Fr: 358 ← [BH: 348, pl. 312 (Boletus)]

bicolor (Campsotrichum) LD 20: 460 ← [EJG 1: 55]

bicolor (Cortinaria) G: 628 ← [PS: 281 (Agaricus)]

bicolor (Diamphora) MNA: 510 (sp. nov.)

bicolor (Hydnum) Fr: 417, not 407 ← [A&S: 270]

bicolor (Peziza) Re: 49, P: 468, M: 22, SA: 532 ← [BH: 243, pl. 410, f. 3] : Fr 2: 92

bicolor (Sphaeria) SA: 521, M: 139 ← [DC 2: 286]

bicolor (Stachylidium) G: 553 ← ["LM 3: 15"] : Fr 3: 391

bicolor (Thelephora) Fr: 438 ← [PS: 568, not Schrader]

bienne (Hydnum) M: 39 ← [PS: 550 (Sistotrema) ← BH: 333, pl. 449, f. 1 (Boletus)]

bienne (Sistotrema) G: 648 ← [PS: 550 ← BH: 333, pl. 449, f. 1 (Boletus)]

biennis (Boletus) P: 441 ← [PS: 550 (Sistotrema) ← BH: 333, pl. 449, f. 1 (Boletus)]

biennis (Daedalea) Fr: 332, P: 247 ← [BH: 333, pl. 449, f. 1 (Boletus)]

biennis (Thelephora) Fr: 449 (nom. nov.)

bifidus (Agaricus) M: 53 (nom. nov.) ← [BH: pl. 26 †, not p. 599]

bifrons (Astoma) G: 525 ← [S: p. f. pl. 316 (Sphaeria)]

bifrons (Sphaeria) P: 494 ← [S: p. f. pl. 316]

bifrons (Xyloma) SA: 518 ← [DC 6: 156]

bifurca (Clavaria) SA: 539, G: 657, M: 31 ← [BH: 207, pl. 264]

biocellata (Erysibe) ENA: 211 (sp. nov.)

bivelus (Agaricus) Fr: 215 ← [FO 2: 58]

blattarius (Agaricus) Fr: 246 (sp. nov.)

blennius (Agaricus) Fr: 67 (nom. nov.)

bolaris (Agaricus) Fr: 228 ← [PS: 291]

boletiformis (Tremella) P: 512 (nom. nov.)

boltonii (Agaricus) Fr: 303 ← [PS: 415]

boltonii (Prunulus) G: 632 (nom. nov.)

bombardica (Sphaeria) P: "282," 492, G: 527 ← [Bolt: 122 "bombardica" ← BEFC 1: 271 "bombarda"] : Fr 2: 456 "bombarda"

bombycina (Byssus) G: 558 ← [Roth 3: 563]
bombycinus (Agaricus) Fr: 277 ← [Sch 4: 42, pl. 98]
borealis (Polyporus) Fr: 366 (sp. nov.)
botrytis (Clavaria) Fr: 466, K: 33, N&B: 344 ← [PCC: 41]
botrytis (Mucor) G: 561 ← [S: p. f. pl. 359 "botritis"]
bovinus (Boletus) Fr: 388, P: 436, H: 26 ← [LSP: 1177]
brasiliensis (Daedalea) Fr: 332 (nom. nov.)
brassicae (Astoma) G: 524 ← ["Dick 1: 23" (Sphaeria)]
brassicae (Sclerotium) G: 591 ← [PD: 15] : Fr 2: 249 (Sclerotium semen [var.] ______)
brevipes (Agaricus) M: 72, N&B: 316 ← [BH: 594, pl. 521, f. 2]
brevipes (Gymnopus) G: 609 ← [BH: 594, pl. 521, f. 2 (Agaricus)]
brumalis (Agaricus) Fr: 171 ← [FO 2: 206]
brumalis (Polyporus) Fr: 348 † ← [PD: 27]
brunneus (Agaricus) Fr: 211 ← [PS: 274]
bryophilus (Cantharellus) Fr: 325 ← [PS: 495 (Merulius) ← POM 1: 8 (Agaricus)]
buccinalis (Merulius) P: 180 ← ["With. IV 4: 146"]
bufonius (Agaricus) Fr: 88, not 83 ← [PS: 359]
buglossoides (Fistulina) SA: 546 ← [BH: 314, pl. 464]
bulbiger (Agaricus) Fr: 27 ← [A&S: 150]
bulbosa (Amanita) G: 599 ← [Sch 4: 61, pl. 241 (Agaricus)]
bulbosa (Aregma) Schl: 56 ← [?Fr]
bulbosa (Cortinaria) G: 630 ← [PS: 295 (Agaricus) ← S: p. f. pl. 130*]
bulbosum (Stilbum) G: 564 ← [TM 1: 10]

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*Two distinct concepts surround this name. One, that of an *Amanita* (cf. PS: 250, DC 2: no. 564, etc.) was adopted by L, M, N&B and SA. The other, that of a *Cortinarius* (cf. PS: 295, etc.) was adopted by P. Fries used the name under *Agaricus* Tribe *Cortinarius*, but cited Sowerby as authority, including PS: 295 ("195") as an additional synonym. Sowerby's concept was clearly an *Amanita*, for he informally proposed it as a variety of *Agaricus muscarius*.

bulbosus (Agaricus) L: 476, M: 88, N&B: 306, SA: 589 ← [Sch 4: 61, pl. 241]
bulbosus (Agaricus) Fr: 214, P: 407 ← [PS: 295 ← S: p. f. pl. 130*]
bulbosus (Agaricus) F: 249 † ← no author, no reference
bullaceus (Agaricus) Fr: 297, M: 58 ← [BH: 421, pl. 566, f. 2]
bullata (Sphaeria) H: 5, N&B: 298 ← ["Hoffm. veg. crypt. 1: 5 " (?polynomial)] : Fr 2: 349
bullata (Stilbospora) Schl: 59 (sp. nov.)
bullatum (Sclerotium) SA: 618 ← [DC 6: 113] : Fr 2: 259
bulliardi (Agaricus) Fr: 221 ← [PS: 289 (Agaricus ______) ← POM 2: 43 (Agaricus
    bombycinus var. ______)]
bulliardi (Daedalea) Fr: 338 (nom. nov.)
bulliardi (Helvella) M: 30 ← [DC 2: 246 ← PS: 612 (Leotia)]
butyraceus (Agaricus) Fr: 121, M: 73 ← [BH: 615, pl. 572]
buxiaria (Sphaeria punctiformis var.) M: 146 (var. nov.) : Fr 2: 525
byssiseda (Clavaria) Fr: 476 ← [POM 1: 32]
byssiseda (Sphaeria) M: 144, LD 22: 386 ← [TM 2: 10 "byssyseda"] : Fr 2: 442
byssisedus (Agaricus) Fr: 276 ← ["PID pl. 14, f. 4"]
byssoidea (Rhizomorpha) M: 137 ← [DC 6: 116 "bissoidea"]
byssoidea (Sphaeria) G: 527 ← [TM 2: 10 (Sphaeria ______ fusca †)]
byssoides (Auricularia) M: 35 ← [PS: 577 (Thelephora)]
byssoides (Clavaria) M: 31 ← [BH: 209, pl. 415, f. 2]
byssoides (Corynoides) G: 654 ← [S: p. f. pl. 335 (Clavaria)]
byssoides (Himantia) LD 21: 163 ← [FOM 2: 284 ← PS: 577 (Thelephora)]
byssoides (Periconia) M: 18 ← [PS: 686] : Fr 3: 343 (Sporocybe)
byssoides (Thelephora) Fr: 452 ← [PS: 577]

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* See previous footnote.

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A NEW NORTH AMERICAN SPECIES OF THE LICHEN GENUS GOMPHILLUS

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While collecting lichens and bryophytes in the vicinity of a large granitic outcrop in Wake County, North Carolina, I discovered an undescribed species belonging to the lichen genus *Gomphillus* Until now only one species, *G. calicioides* (Duby) Nyl., had been recognized in the genus. It does not occur outside of Europe.

Gomphillus americanus Essl., sp. nov. Figures 1 and 2

Similis *G. calicioides* sed apothecia matura fatiscentia et stipitatescens differt.

Thallus crustose, thin and membranous, white to pale greenish-white or grayish-green, growing in roughly orbicular patches from a few centimeters to (rarely) as large as 15 cm in diameter. Mature apothecia dark brown or blackening, paler below, sessile but often appearing very short stipitate because of the pale, slightly narrowed base, (300-) 380-800 µm tall, 250-500 µm in diameter, mostly one- or two-headed, occasionally polycephalic; postmature apothecia disintegrating or dissolving and becoming distinctly stipitate, the stipe 1-3.5 mm long and 110-230 µm in diameter, slightly wider at the base and tapering upward, mostly pellucid-whitish, sometimes darkening slightly. Asci 280-340 x 7-10 µm, cylindric; spores 180-240 µm long and (1.5-) 2-2.5 (-3) µm in diameter, transversely many-septate (the cells mostly 2-6 µm long); paraphyses less than 1 µm in diameter, branched and anastomosed. Thallus, apothecia and stipes all color tests negative (the moss substrate is sometimes K+ orange-yellow). Constituents: Atranorin (slight) and traces of 2 or 3 terpenoid compounds (these latter may have come from the substrate moss).

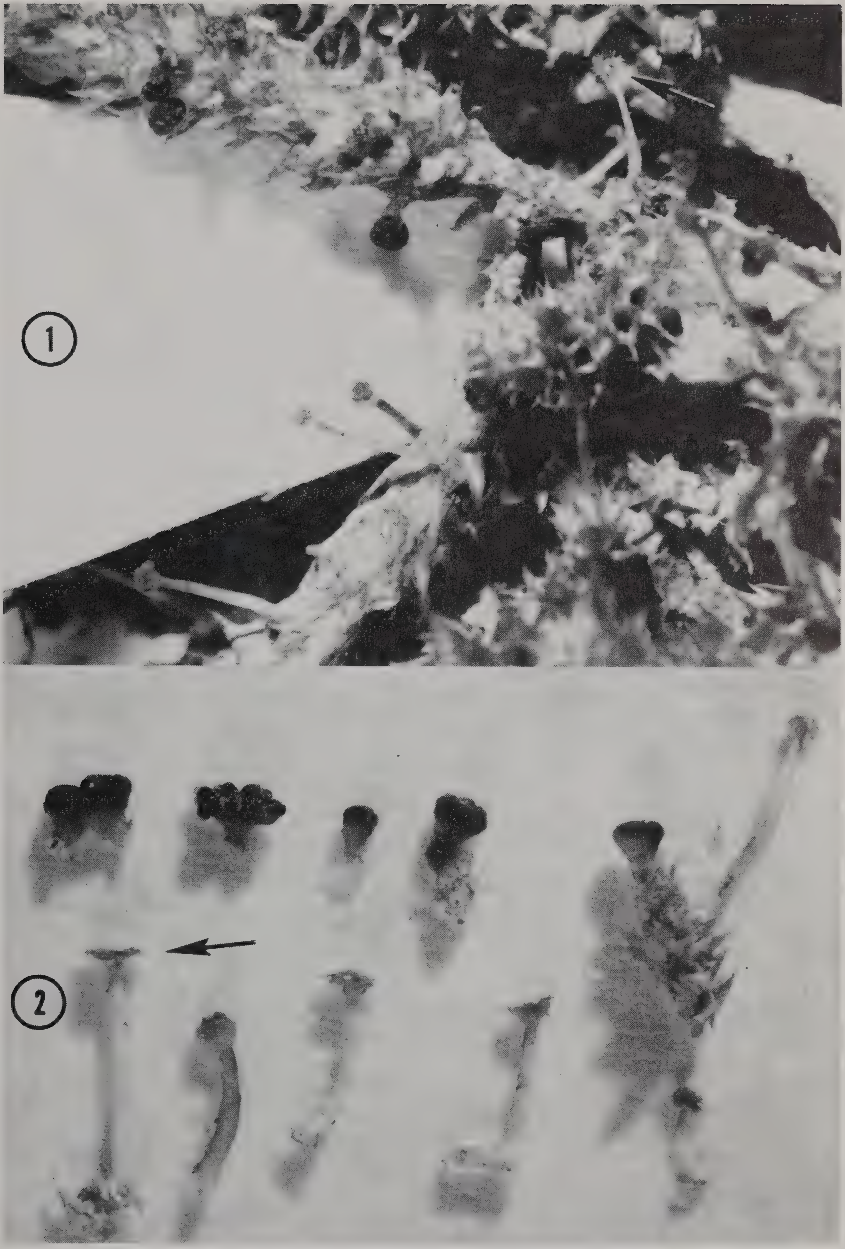
Type: U.S.A. North Carolina. Wake Co.: ca. 5 mi. SE of the town of Wake Forest in the vicinity of a large granite outcrop along the Cedar Fork of the Little River (35° 55' N lat., 78° 23' W long.); growing over mosses (mostly *Entodon seductrix* (Hedw.) C.M. and *Leucodon julaceus* (Hedw.) Sull.) on a hardwood log, 28 March 1971, Esslinger 3184A (US, holotype; DUKE, Herb. Esslinger, isotypes). The following collections were made in different spots at the same locality on 15 March 1974: over mosses (mostly *L. julaceus*) and the immediately adjacent bark on a hardwood log, Esslinger 4156 (US, DUKE, Herb. Esslinger); over mosses (*L. julaceus* and *Thuidium delicatulum* (Hedw.) BSG) on the base of living *Juniperus virginiana*, Esslinger 4157 (Herb. Esslinger); over mosses (*L. julaceus*) on a branch of living *Juniperus virginiana*, three or four feet above the ground, Esslinger 4158 (Herb. Esslinger).

Gomphillus americanus and the European *G. calicioides* are very similar in most respects. The appearance of the mature apothecia, externally and internally, is virtually identical in both species although the apothecia and spores of *G. americanus* seem to average slightly larger than those of *G. calicioides*. The major difference between *G. calicioides* and *G. americanus* is the very peculiar manner in which the postmature apothecia of the latter species dissolve and become stipitate. Nothing similar to this was observed in any of the material of *G. calicioides* available to me (cited below) nor was any mention of such a development found in the literature.

Although the mature apothecia (nonstipitate) and postmature apothecia (stipitate) of *G. americanus* occur intermixed on the thallus, few intermediate stages between the two types were seen. The process of stipe formation and apothecial dissolution in this species is apparently quite rapid. By the time the stipe has formed, very little of the apothecium itself is left. At the top of an elongated stipe, all that remains to be seen of the apothecium is a strange appearing, pale to often somewhat darkened fringe (Figs. 1 and 2, arrows) apparently formed from what remains of the paraphyses and possibly some excipular material. Often, just below this fringe is a pellucid swelling that appears to be part of the stipe but which, upon wetting, becomes gelatinous. This gelatinous material consists of a mass of spores and possibly also some paraphyses. No traces of asci can be detected at this stage.

The systematic position of the genus *Gomphillus* is uncertain. Generally it has been aligned with *Baeomyces* in the Cladoniaceae (Duby, 1830; Nylander, 1860; Zahlbruckner, 1905; Räsänen, 1943) although Nylander (1855) in his original description of the genus, placed it in the tribe Lecidinei. Its supposed relationship to *Baeomyces* was based largely on the stipitate appearance of the apothecia. As recently demonstrated by Jahns (1970), however, the apothecia of *G. calicioides* are not truly stipitate but simply appear so because they are slightly taller than they are broad and because the base is narrower and often paler than the upper part. Mature apothecia of *G. americanus* are similarly pseudostipitate but become truly stipitate in the postmature stage. Recently several authors (Poelt, 1973; Henssen & Jahns, 1974) have followed Nylanders original proposal to place *Gomphillus* in the Lecideaceae. While this disposition for the genus is certainly more satisfactory than in the Cladoniaceae, the extreme heterogeneity of the Lecideaceae is only magnified by such a move. Although superficially similar to certain species of *Bacidia*, *Gomphillus* has no close relatives in the Lecideaceae and should probably eventually be placed in a family of its own.

Although it is doubtless not a common lichen, *G. americanus*



Figures 1 and 2. *Gomphillus americanus*. Fig. 1: Thallus and apothecia on the natural substrate. Fig. 2: Various mature and post-mature apothecia. In both figures the arrow is pointing to a remnant apothecial fringe at the top of a stipe. × 14.

will probably be found to have a distribution considerably broader than that indicated by the few collections cited here. It is a very inconspicuous and easily overlooked lichen, often appearing like little more than discolored patches on the substrate moss. The apothecia are virtually invisible without the use of a hand-lens and even with one their nature is not immediately clear. Considering the rather broad distribution of *G. calicioides* through much of southern Europe, it would not be surprising to find this new species in scattered localities throughout much of the southeastern deciduous forest.

The following specimens of *G. calicioides* from Europe were examined:

FRANCE. Basses Pyrénées: Haute-Saule, Aussurucq, Arbailles alt. 600 m.s.m., ad truncum muscosum Fagi Silvaticae, Vivant, 28.XII. 1972, in Vězda, Lich. Sel. Exs. 1167 (US, DUKE). Manche: Bricquebec, sur les troncs, De Brébisson s.n., in Malbranche, Lich. Norm. 393 (DUKE; mixed with *Baeomyces rufus* (Huds.) Rebent.); Forêt de Bricquebec, Roumeguère, 1870 (US).

ITALY: Quercia al Montello, Beltramini, 26.III.1856 (US).

PORTUGAL. Estremadura: Serra de Sintra, Cruz Alta, ad muscos et supra cortices vetustas Cupressorum cultarum, circ. 480 m.s.m., Tavares, 1946, in Tavares, Lich. Lusitaniae Sel. Exs. 11 (US).

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CHLOROSPLENIUM AND ITS SEGREGATES. II. THE GENERA CHLOROCIBORIA AND CHLORENCOELIA[1]

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ABSTRACT

Four species of *Chlorociboria* are recognized in this monograph; one is divided into two geographically disjunct subspecies, both of which are associated with a phialoconidial state, *Dothiorina tulasnei*. A new species, C. argentinensis, and two new combinations, *C. aeruginascens* subsp. brasiliensis and C. omnivirens, are proposed. Six species and two varieties previously assigned to the genus are reassigned to other genera.

A new genus, Chlorencoelia, and the new combinations C. versiformis and C. torta are proposed for two species previously treated as members of *Chlorosplenium* and *Chlorociboria*.

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THE GENUS CHLOROCIBORIA SEAVER emend. DIXON

When Seaver (1936) erected the genus *Chlorociboria* he did not specifically indicate a taxonomic position for the genus. In 1951, Seaver placed this genus in the family Helotiaceae, tribe Helotieae. Rehm (1893) placed the species now in *Chlorociboria* in the Helotiaceae ("Helotieae") subtribe Ciboriinae ("Ciborieae"). Nannfeldt (1932) placed these species in his family Helotiaceae subfamily Ombrophiloideae. White (1941) suggested that *Chlorociboria* might prove to belong to the Ciborioideae of Nannfeldt (1932), which Whetzel (1945) raised to family rank as the Sclerotiniaceae. Dennis (1956) placed the genus *Chlorociboria* in the Helotiaceae subfamily Phialeoideae. In 1968 Dennis, under the name of *Chlorosplenium,* treated this genus in the Helotiaceae tribe Helotieae (ut "Helotioideae"). Ramamurthi, Korf and Batra (1958) placed the genus in the Sclerotiniaceae and Korf (1958) wrote, "The discovery of at least three Japanese species in which the ascospores regularly germinate by spermatia (much as in some species of *Rutstroemia)* lends additional weight to my view that the genus is correctly a member of that [Sclerotiniaceae] family." Berthet (1964b), however, pointed out, "*Chlorosplenium aeruginosum,* comme nous le signalions dès 1961, possède un mycélium aux articles uninucléés; cette espèce doit donc être placée, comme nous l'avions fait alors, dans les HELOTIACEAE, et rien ne permet d'en faire une SCLEROTINIACEAE, comme l'ont fait Ramamurthi, Korf et Batra (1957), puis Korf (1958, 1959b)."

On the basis of my study, I find that this genus fits very well in the Leotiaceae (= Helotiaceae) as most other authors have concluded. However, its gelatinous hyphae, its ability to stain wood, its production of microconidia from ascospores and its general morphological features recall several species of *Claussenomyces*. I conclude that *Chlorociboria* should be considered a member of the subfamily Leotioideae, tribe Leotieae. It should also be pointed out that the granularly roughened tomentum hyphae remind one of the granularly roughened hairs exhibited in the Hyaloscyphaceae, both in members of the Trichoscyphelloideae and Hyaloscyphoideae, and the genus *Chlorociboria* may prove to be a connecting link to this family as well.

The pigmentation exhibited by members of this genus has been studied in *Chlorociboria aeruginosa*. Recently Blackburn et al. (1962, 1965) have elucidated the structure of this pigmentation and have confirmed the conclusions of Rommier (1868), Lieberman (1874), Frenzel (1928), and Kogl et al. (1925, 1930a, 1930b) that Xylindein (a peri-hydroxy-quinone compound) is responsible for the green coloration of this fungus. Xylindein is formed by the hyphae of the fungus, and even though not readily soluble in water, it does leach from the hyphae staining the substrate which in time displays the aeruginous coloration typical of the fungus. Berthet (1964b) wrote, "*Chlorosplenium aeruginosum* possède des hyphes dont les inclusions lipidiques sont colorées en bleu-vert intense," and in regards to the hyphae of the "stroma" produced in culture, "Ce pigment se trouve répandu dans le milieu en amas irréguliers, probablement à la mort des hyphes qui le renfermainent."

Berkeley (1860) wrote that the "spawn" of *Chlorosplenium aeruginosum* (most likely *C. aeruginascens* since *C. aeruginosum* does not appear to occur in England) is used by craftsmen in Tunbridge Wells. Evidently they allow the mycelia to develop in the wood and after the wood has been stained, it is manufactured into various objects, *i.e.*, boxes, toys, bowls, etc. According to the Encyclopaedia Brittanica (Anon., 1964), "The industry known as Tunbridge Wells ware continued during 300 years, but the factory closed and the small existing supply comes from the spare work of old hands."

GENERIC DIAGNOSIS
OF THE GENUS CHLOROCIBORIA SEAVER emend.
(HELTOIALES, LEOTIACEAE)

CHLOROCIBORIA Seaver ex Ram., Korf & Bat., Mycologia 49: 857. 1958, emend. Dixon

≡[*Chlorociboria* Seaver, Mycologia 28: 390. 1936, not validly published, no Latin diagnosis nor reference to a previously and validly published Latin diagnosis.]

NAME: from Greek, "Chloris," the green one, and *Ciboria,* genus of Inoperculate Discomycetes; referring to the color of the apothecia and the taxonomic affinity to the genus *Ciboria.*

HOLOTYPE: Helvella aeruginosa Oeder per Purton [= *Chlorociboria aeruginascens* (Nyl.) Kanouse ex Ram., Korf & Bat.], selected by Seaver (1936) and Ramamurthi, Korf and Batra (1958).

PHIALOCONIDIAL STATE: Dothiorina von Höhnel.

Apothecia: superficial, solitary to caespitose, centrally to excentrically stipitate, fleshy to coriaceous.

Disc: shallow cupulate to infundibuliform, orangish-yellow to aeruginous and concolorous with the receptacle.

Receptacle: glabrous or finely tomentose, or with dark aeruginous pustules.

Stipe: glabrous to finely tomentose to heavily pustulate with dark aeruginous pustules.

Asci: cylindric-clavate with long tapering stalks, apex rounded to subconic and inoperculate, J+, arising from repeating croziers.

Ascospores: fusiform to fusiform-elliptic, in some species sub-allantoid, unicellular to occasionally 1-septate, hyaline or with green contents.

Paraphyses: filiform, blunt at the apex, hyaline, septate, branching near the base.

Subhymenium: not always distinctly delimited, composed of tightly compacted textura intricata.

Medullary Excipulum: of loose to tightly compacted, hyaline to aeruginous, gelatinized textura intricata.

Ectal Excipulum: of gelatinized, hyaline (in young specimens) to heavily pigmented (in more mature specimens) textura intricata, or textura angularis to textura globulosa. Substrate always stained aeruginous and usually stained in ar extended area.

Habitat: on decayed and decorticated wood.

NOMENCLATURAL STATUS OF THE SPECIFIC EPITHETS "AERUGINOSA" AND "AERUGINASCENS"

Confusion exists in the literature concerning the application of the specific epithets "aeruginascens" and "aeruginosa." It has become increasingly clear that (1) the names *Peziza aeruginosa* and *P. aeruginascens* are in desperate need of typification, (2) that every attempt should be utilized to follow the spirit of the International Code of Botanical Nomenclature's Recommendation 7b as adopted at the Seattle Congress (Stafleu and Voss, 1969) which states: "Whenever the elements on which the name of a taxon is based are heterogeneous, the lectotype should be so selected as to preserve current usage unless that element is discordant with the original description and (or) figure," and (3) that any means possible should be used to avoid burdening the literature with another name for a taxon which already has a valid name.

Let us examine the history of these two specific epithets. In 1770 Oeder in the *Flora Danica* [vol. 3 (Fasc. 9): 7, Tab. 534, fig. 2] described and illustrated under the polynomial "Elvela aeruginosa, minima pileo difformi viridissima" a specimen collected by J. G. König in Iceland. Twenty-five years later Persoon (1795) erected independently the species *Peziza aeruginosa*. Later, Persoon (1801) in his *Synopsis Methodica Fungorum* page 663 again described *Peziza aeruginosa* and on page 617 of the same work cited *Helvella ? aeruginosa* based on the description and illustration of Oeder.

Nylander (1869) erected *Peziza aeruginascens* for a species similar to *P. aeruginosa* Pers., but with smaller spores (6-8 × 1.5-2.5 µm). He wrote: "*P. aeruginosa* Raven. Fung. Carol. V, 40, et auctor omnium pr. p.; *Chlorosplenium aeruginosum* Tul. Sel. Fung. Carp. III, p. 187, t. 20, f. 15-19, cum spermogonis." Almost all later authors because of the similarity of the specific epithets have assumed that *Helvella aeruginosa* Oeder and *Peziza aeruginosa* Pers. were synonymous. This is in fact *not* the case. *Peziza aeruginosa* of Persoon is a large-spored fungus known to Nylander (1869), Schumacher (1803), Albertini and Schweinitz (1805), Schweinitz (1822), etc. It is *Helvella aeruginosa* Oeder (never placed in *Peziza*) which is the fungus named by Nylander (1869) as *Peziza aeruginascens*. Mistakenly, Persoon himself

(1822) synonymized the two species.

Which of the two identical species epithets did Fries 'sanction' when he treated *Peziza aeruginosa* in the *Systema Mycologicum* 2(1): 130. 1822? Both appear in his synonymy. The index to volume 2 is of no help in this instance, for no author is credited there. The index to the whole work, in volume 3, cites the author as "Fl. Dan." But Fries had cited two plates of the *Flora Danica,* one (534) being Oeder's species, the other (1260) being Persoon's. It is only in the *Systema Mycologicum* 2(1): 22. 1822 that the answer is to be found, for here Fries unequivocally states: "H[elvella]. aeruginosa *Pers. syn.* est P. aeruginosae varietas." Fries thus accepted Persoon's name as the basis of the species, not Oeder's. Even though Fries (1822) synonymized the two species, he clearly had Persoon's fungus in mind when he drew up the description of *Peziza aeruginosa,* because the excentrically stipitate fungus illustrated by Holmskjøld (1799) as *P. aeruginosa* was different enough for Fries to recognize it as a variety, *P. aeruginosa* var. *subgrisea.* Holmskjøld's illustration is undoubtedly the same fungus called *P. aeruginascens* by Nylander.

The small-spored fungus *(P. aeruginascens)* which occurs in Europe and Scandinavia became known by the misapplied name, *P. aeruginosa.* Since *P. aeruginascens* was the same fungus, it has been treated as a synonym of *P. aeruginosa* by various workers. In North America, where both species occur sympatrically, workers such as Kanouse (1947) and Ramamurthi, Korf and Batra (1958) recognized Nylander's *P. aeruginascens* as well as *P. aeruginosa* in the concept of Persoon, but attributed, in error, the latter specific epithet to Oeder instead of to Persoon.

Neither of these species has been lectotypified. An attempt to locate an authentic specimen from Oeder's herbarium and an authentic specimen from Persoon's herbarium was made. I have examined the only remaining specimen labelled *P. aeruginosa* in the Persoon herbarium and find it to be *P. aeruginascens* Nyl. I therefore avoided typifying *P. aeruginosa* by this specimen. Attempts to locate an Oeder specimen of *Helvella aeruginosa* were fruitless, and Dr. Skovsted of the Botanical Museum and Herbarium, Copenhagen, informed me (pers. comm.), "There are scarcely any fungi left of those used for the illustrations in *Flora Danica,* and I believe that König's material from Iceland has been lost." It is possible under the International Code of Botanical Nomenclature to typify the species by *Flora Danica* Tab. 534, but I felt that since this species is so poorly illustrated, having only a habit sketch, that this would not be suitable.

In hopes of conserving the current usage of these specific epithets, I am neotypifying *Peziza aeruginosa* by a specimen from the Fries herbarium at Uppsala which preserves Fries's concept of the species, preserves current usage, and which conforms with Persoon's original concept of the species. I am also lectotypifying *P. aeruginascens* by one of the syntype specimens from the Nylander herbarium now on deposit at Helsinki. I hereby designate this same Nylander collection as the neotype of *Helvella aeruginosa* Oeder per Purton. In so doing I am adopting a position that will conserve the usage of these specific epithets by such authors as Kanouse (1947), Ramamurthi, Korf and Batra (1958), Korf (1958, 1959a, b), Dennis (1960, 1968, 1970, 1972), Gamundí (1962), etc.

KEY TO THE SPECIES OF CHLOROCIBORIA

1. Ectal excipulum giving rise to tomentum hyphae....... 2

1'. Ectal excipulum not giving rise to tomentum hyphae, but instead at points along the ectal excipulum forming conical mounds of heavily pigmented and granulated textura angularis to textura globulosa which project almost perpendicularly from the flanks of the apothecium... 4

2 (1). Ectal excipulum giving rise to few to numerous, coiled or sometimes straight, smooth-walled tomentum hyphae; often with several apothecia arising from each darkly pigmented, irregularly shaped fundament or "stromatic mass," excentrically stipitate to infrequently centrally stipitate................................ 3

2'(1). Ectal excipulum giving rise to few to numerous, straight or coiled, strongly granularly roughened tomentum hyphae, apothecia arising singly from a scarcely differentiated, darkly pigmented, irregularly shaped fundament or "stromatic mass;" centrally stipitate to rarely excentrically stipitate, ascospores (8-) 9-14 (-15) × 2-4 µm....................... 1. *C. aeruginosa*

3 (2). Ascospores 5-7 (-10) × 1.0-1.5 (-2.4) µm; asci (40-) 50-65 (-75) × 3-4 (-5) µm........................... 2. *C. aeruginascens* subsp. *aeruginascens*

3'(2). Ascospores 3.0-5.5 (-6) × 1-1.5 µm; asci (35-) 41-49 × 3-4 µm... 3. *C. aeruginascens* subsp. *brasiliensis*

4 (1'). Ascospores (7-) 9.0-10.2 (-11) × 1.7-2.0 µm; several apothecia arising from each darkly

pigmented, irregularly shaped fundament or "stromatic mass;" centrally stipitate...... .... 4. *C. argentinensis*

4'(1'). Ascospores (11-) 14-18 (-20) × 3-4 µm; apothecia arising singly from a scarcely differentiated, darkly pigmented, irregularly shaped fundament or "stromatic mass;" centrally substipitate to stipitate........... .... 5. *C. omnivirens*

THE PERFECT STATES OF CHLOROCIBORIA

1. CHLOROCIBORIA AERUGINOSA (Pers. per Pers. : Fr.) Seaver ex Ram., Korf & Bat. [ut "(Oed. ex Gray) Seaver"], Mycologia 49: 859. 1958.
    ≡[*Peziza aeruginosa* Pers., [Neue] Ann. Bot. (Usteri) [Stuck] 9: 27. 1795.]
    ≡ *Peziza aeruginosa* Pers. per Pers., Myc. Eur. 1: 291. 1822 (pro parte typica) : Fr., Syst. Mycol. 2(1): 130. 1822 (pro parte typica). (!!)
    ≡ *Chlorosplenium aeruginosum* (Pers. per Pers. : Fr.) Auct., non *C. aeruginosum* (Oeder per Purton) de Not. 1864.
    ≡[*Chlorociboria aeruginosa* (Pers. per Pers. : Fr.) Seaver [ut "(Oed.) Seaver"], Mycologia 28: 391. 1936, pro parte typica (genus not validly published).]

= *Peziza aeruginea* Berk., Hooker's J. Bot. Kew Gard. Misc. 6: 210. 1854. (!!)
    ≡ *Chlorosplenium aerugineum* (Berk.) Sacc., Syll. Fung. 8: 318. 1889.

= *Chlorosplenium discoideum* Massee, Brit. Fungus-Fl. 4: 286. 1895. (!!)

(Figs. 19-20, 28)

Apothecia: superficial, solitary to gregarious, never with several apothecia arising from the same fundament or "stromatic mass," centrally to slightly excentrically stipitate.

Disc: < 5 mm in diam, cupulate to rarely convex-plane, color varying even in the same collection from orange-yellow to almost concolorous with the receptacle to light pea-green (Capucine Yellow to Sorrento Green to Pale Cendre Green) when fresh, becoming slightly darker from that in the fresh state to greenish-black upon drying, edges of disc enrolling to the point of often touching.

Receptacle: glabrous or finely tomentose, pustulate, aeruginous (Sorrento Green to Dark Viridian Green) when fresh, becoming bluish-aeruginous upon drying, often vertically ribbed or rugose, especially upon drying.

Stipe: < 3 × 0.5-1.0 mm, concolorous with the receptacle, pustulate (often more so than the receptacle), on breaking showing an outer aeruginous cortex with an orange-yellow (Capucine Yellow) medullary tissue.

Hymenium: (55-) 75-90 (-106) μm high, hyaline to aeruginous, often with portions of the hymenium becoming more darkly pigmented.

Asci: cylindric-clavate, with a long tapering stalk, (57-) 68-80 (-95) × (4.0-) 5-7 (-7.5) μm (mean of collections 79 × 7 μm), strongly J+, 8-spored, wall at apex 1.0-1.5 μm thick, 0.25-0.5 μm thick along the sides of the ascus, arising from repeating croziers.

Ascospores: irregularly biseriate, unicellular to submedian 1-septate, fusiform-elliptic, hyaline or with light green contents, prominently biguttulate and/or with several smaller guttules, (8-) 9-14 (-15) × 2-4 μm (mean of collections 13 × 3 μm), spores often germinating in the ascus by unipolar or bipolar germ tubes, with occasional globose or subglobose microconidia 1.0-2.5 μm in diam being produced at the ends of the germ tube and floating free in the mounting media.

Paraphyses: filiform, blunt at the apex, hyaline, septate, branching near the base, (1.0-) 1.5 (-2.0) μm in diam, scarcely extending beyond the asci.

Subhymenium: (5-) 10-25 (-45) μm thick, of hyaline to aeruginous textura intricata, hyphae 1-3 μm in diam.

Medullary Excipulum: of gelatinized, thin-walled, loose to tightly compacted textura intricata, hyaline to light green (an occasional specimen dark green), hyphae sympodially branched, (2-) 3-4 (-5) μm in diam.

Ectal Excipulum: 15-85 μm thick, of green hyphae forming a single layer of gelatinized hyaline and/or green, granulated textura intricata, textura epidermoidea or textura oblita, dark aeruginous in fully mature apothecia, ectal excipular hyphae giving rise to straight or coiled, strongly granularly roughened tomentum hyphae, in old and in fully mature specimens the outer layer often becoming brown, especially in the lower portion of the stipe.

Habitat: on decayed and decorticated wood; collected on wood of *Abies, Acer, Akebia, Alnus, Betula, Carpinus, Corylus, Fagus, Fraxinus, Liriodendron, Nothofagus, Picea, Pinus, Populus, Prunus, Salix, Tsuga, Quercus* and unidentified wood.

Range and Seasons of Fructification: North, South and Central America, China, India, Japan, Philippines, Union of Soviet Socialist Republics; Spring, Summer and Autumn.

Name: from Latin, "aeruginosus," deep-green, with a mixture of blue, referring to the color of the apothecia.

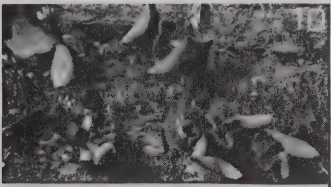
Neotype Locality: unknown.

Neotype Specimen: Helotium aeruginosum, in lignis *Betula,* (locality unknown), Kalchbrenner, (no date), UPS-Fries No. 287 (= CUP 51738).

Illustrations: Vahl., Fl. Danica Tab. 1260. 1797 (ut *Peziza*); Weberbauer, Pilze Norddeuts. 1: Tab. 1, fig. 5a, b, & c. 1873 (ut *Peziza*)!; Saccardo, Fungi Italici, Tab. 1348. 1883 (ut *Helotium*); Boudier, Ic. Mycol. Tab. 485. 1908 (ut *Chlorosplenium*)!; Migula, Kryptog.-Flora in Thomé's Fl. Deuts. $3(3^2)$: Pl. 166, figs. 4-6. 1913 (ut *Chlorosplenium*)!; Akai, Bot. & Zool. 2: 835, fig. 2. 1934 (ut *Chlorosplenium*); Le Gal, Prodr. Flore Mycol. Madagascar 4: 363, fig. 161. 1953 (ut *Chlorociboria*); Gamundí, Darwiniana 12: Pl. 5, figs. 1-7. 1962 (ut *Chlorosplenium*)!; Ramamurthi, Korf and Batra, Mycologia 49: 856, fig. 1. 1958 (ut *Chlorociboria*)!; Korf, Sci. Rep. Yokohama Natl. Univ. Sect. 2, Biol. Sci. 7: 25, figs. 7 & 10. 1959 (ut *Chlorociboria* et Tax. sp. 3)!.

Exsiccati: Ellis, North American Fungi No. 987 (ut *Chlorosplenium*) CUP-A, CUP-D 11212 (76-26); Fuckel, Fungi Rhenani No. 1158 (ut *Helotium*) FH (= CUP 52690); Herbier Barbey-Boissier No. 1279 (ut *Chlorosplenium*) BPI; Libert,

FIGS. 10-23. Photographs of *Chlorociboria* spp. and of *Dothiorina tulasnei*. FIGS. 10-14. *C. aeruginascens*. 10. Rehydrated apothecia, CUP 51821, approx. × 2.5. 11. Complete section of apothecia, BPI-Jaczewski-s.n., 1895, approx. × 7. 12. Freshly collected apothecia, CUP 51685, approx. × 1.5. 13. Several young apothecia being formed on a single fundament, in section, BPI-Jaczewski-s.n., 1895, approx. × 15. 14. Rehydrated apothecia in side view, CUP 51685, approx. × 1.5. FIGS. 15-18. *Dothiorina tulasnei*. 15. Gross view of young stromata, CUP 52701, × 10. 16. Section of stromata, CUP 51855, × 133. 17. Enlarged view of a pycnidium, CUP 51855, × 770. 18. Side view of a stroma, CUP 52701, × 6. FIGS. 19-20. *C. aeruginosa*. 19. Complete section of apothecium, CUP-VZ 4472, approx. × 12. 20. Rehydrated apothecia, CUP-D 1349 (76-42), approx. × 2.5. FIG. 21. *C. omnivirens*, gross view of rehydrated apothecia, R.P.K.-JA 2079, approx. × 3. FIGS. 22-23. *C. argentinensis*. 22. Dried apothecia, BA 20262, approx. × 4. 23. Dried apothecia, BA 21223, approx. × 2.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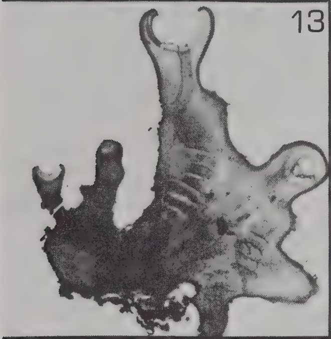
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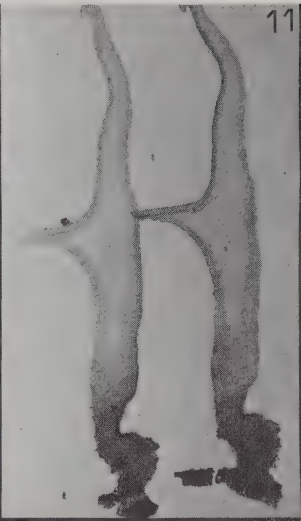
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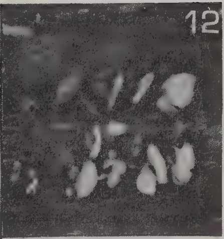
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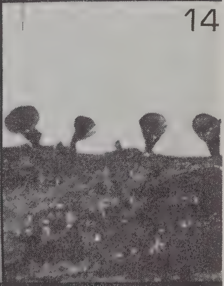
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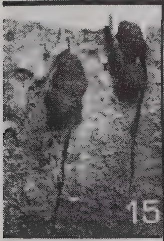
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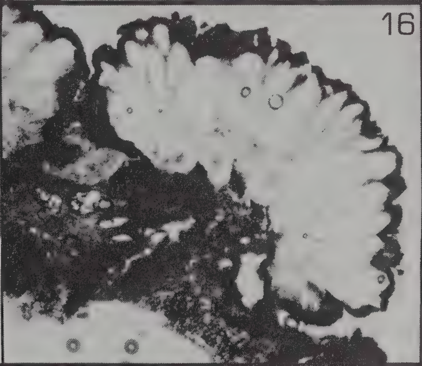
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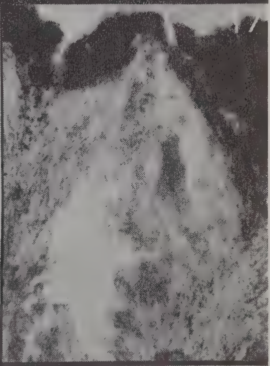

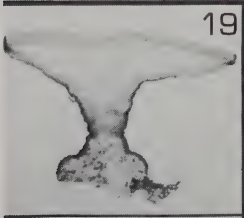
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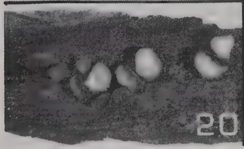
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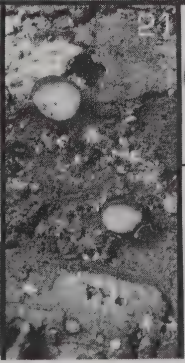
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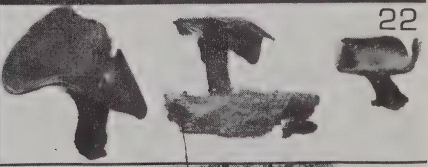
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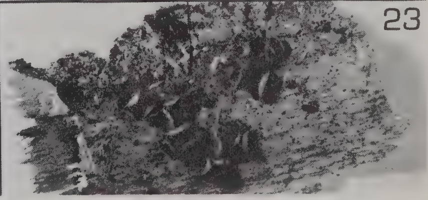
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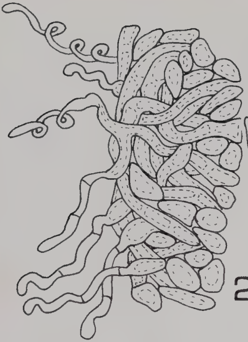
Pl. Crypt. Arduennae No. 328 (ut *Peziza*) PAD-Saccardo (= CUP 51746); Ravenel, Fungi Caroliniana Exs. Fasc. V, No. 40 (ut *Peziza*) FH, CUP-D 6334 (76-68), 3667 (76-49); Rehm, Ascomyceten Exs. No. 409b (ut *Chlorosplenium*) CUP-D 4890 (76-57); Rick, Fungi Austro-Americani Exs. No. 6a (ut *Chlorosplenium aeruginascens*) BPI; Roumeguère, Fungi Sel. Exs. No. 5522 (ut *Chlorosplenium*) CUP-A, CUP-D 11610 (76-25); Roumeguère, Fungi Gallici Exs. No. 1858 (ut *Chlorosplenium*) CUP; Siemaszko, Fungi Bialowiezenses Exs. No. 19 (ut *Chlorosplenium*) BPI, P; Weese, Eumycetes Selecti Exs. No. 127 (ut *Chlorosplenium*) BPI.

Excluded Exsiccati: Berkeley, British Fungi Exs. No. 281 issued as *Peziza aeruginosa* is *Chlorociboria aeruginascens;* Karsten, Fungi Fennici No. 151 issued as *Chlorosplenium aeruginosum* is *Chlorociboria aeruginascens;* Petrak, Flora Bohemica et Moraviae Exs. No. 234 issued as *Chlorosplenium aeruginosum* is *Claussenomyces atrovirens;* Phillips, Elvellacei Britannici No. 86 issued as *Helotium aeruginosum* is *Chlorociboria aeruginascens;* Rabenhorst, Fungi Europaei No. 1310 issued as *Peziza aeruginosa* is *Chlorociboria aeruginascens;* Saccardo, Mycotheca Italica No. 333 issued as *Chlorosplenium aeruginosum* is *Chlorociboria aeruginascens;* Smarods, Fungi Latvici Exs. No. 771 issued as *Chlorosplenium aeruginosum* is *Chlorociboria aeruginascens;* Wilson & Seaver, Ascomycetes and Lower Fungi No. 78 issued as *Chlorosplenium aeruginosum* is *Chlorociboria aeruginascens.*

FIGS. 24-29. Camera-lucida drawings of *Chlorociboria* spp. and of *Dothiorina tulasnei,* × 1000. FIG. 24. *C. aeruginascens* subsp. *aeruginascens.* Portion of ectal excipulum and tomentum hyphae, R.P.K. 3340; ascus, paraphysis, and six ascospores, CUP-D 1221 (76-10). FIG. 25. *C. aeruginascens* subsp. *brasiliensis.* Ascus, paraphysis, and eight ascospores, BPI-Rick, Fungi Austro-Americani No. 6. FIG. 26. *C. argentinensis.* Six ascospores, paraphysis, ascus, and conical mass of hyphae protruding from the ectal excipulum, BA 21223. FIG. 27. *D. tulasnei.* Young phialide, six microconidia, and more mature phialide producing spores, CUP 52701. FIG. 28. *C. aeruginosa.* Seven ascospores, two in process of germination, CUP-D 1349 (76-46); portion of ectal excipulum and tomentum hyphae, CUP-VZ 4522; two paraphyses, ascus, CUP-D 1349 (76-46). FIG. 29. *C. omnivirens.* Six ascospores, two in the process of germination, and scattered microconidia, ascus, paraphysis, and conical mass of hyphae protruding from the ectal excipulum, CUP-JA 52.



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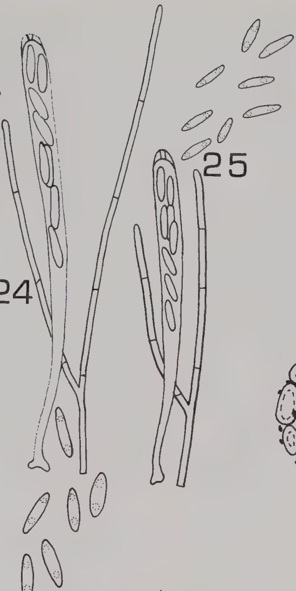

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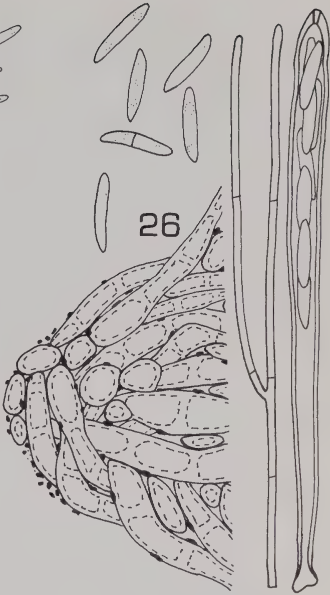

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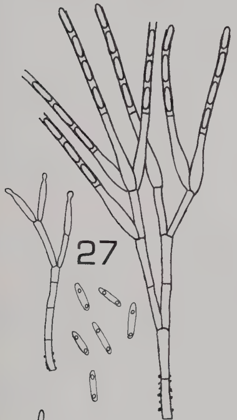

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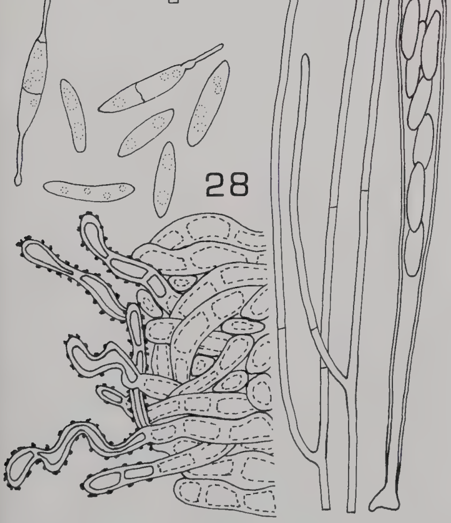

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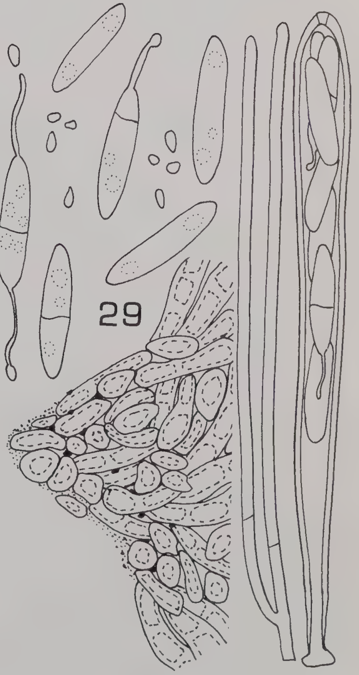

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Specimens Examined: U.S.A. - CALIFORNIA: BPI-Parks s.n., April 7, 1925. IDAHO: BPI-Weir 8067; CUP 51853. INDIANA: CUP-D 10953 (76-71). MICHIGAN: CUP 51774, 51799. MINNESOTA: CUP-D 10668 (76-78). NEW HAMPSHIRE: CUP 19508, 51846. NEW YORK: BPI-Tapke s.n., Spring 1917; CUP 51707, 51837, 51847, 51849, 51852; CUP-A 12168, 14875; CUP-D 1349 (76-42), 2163 (76-43); CUP-LG 137; R.P.K. 2522. OHIO: CUP-D 2717 (76-44), 4940 (76-58). OREGON: BPI-Kienholz K55; OSC 6415, 29395. PENNSYLVANIA: CUP 131, 45629; PH-Schweinitz Syn. 899, 156 (substrate unknown), Schweinitz, (date unknown), Bethlehem, ut *Peziza aeruginosa*. WASHINGTON: BPI-Humphrey s.n., Oct. 12, 1909, 9-15-1910 on *Alnus*, 9-15-1910 on *Tsuga heterophylla?;* BPI-Weir s.n., Sept. 1915. WYOMING: CUP-D 9863 (76-75).

ARGENTINA: BA-20361, 20557 (= R.P.K. 2985), 20873, 20875, 21001, 21127, 21785; BA-Singer 3371; R.P.K. 2955.

BRASIL: BPI-Rick s.n., 1923.

CANADA - QUEBEC: BPI-McKeen s.n., Nov. 26, 1950; CUP 52347.

CHINA: BPI-Deng 5191, 7541, Shen 340, Shen s.n., Sept. 22, 1933, Tsiang 260.

COSTA RICA: BPI-Quiros s.n., July 4, 1948.

ENGLAND: Holotype of *Chlorosplenium discoideum* Massee, on green colored wood of *Robinia* sp., Kew Gardens, Massee, 9/1894, NY (= CUP 51727); Isotype: CUP-D 8050 (77-50).

INDIA: Holotype of *Peziza aeruginea* Berk., on dead wood, Khasia, Hooker and Thomson, (no date), K-Berkeley (= R.P.K. 2939); Isotype NY-Massee, s.n.; CUP-IN 463, 464.

JAMAICA: BPI-Orcutt 5716, Welden 571, 928, 950; CUP-D 8043 (76-73), 4980 (77-121).

JAPAN - HOKKAIDO: CUP-JA 2631. HONSHU: CUP-JA 1602 (=TNS 201039), 1803, 3514; R.P.K.-JA 1682, 1686. KYUSHU: CUP-JA 401, 419, 1531. YAKU ISLAND: CUP-JA 2020, 2026, 2058.

MEXICO: CUP-ME 159.

PANAMA: BPI-Martin 2199, 2398, 2773.

PHILIPPINES: CUP-SA 1538, 1586, 1624, 1629.

UNION OF SOVIET SOCIALIST REPUBLICS - RUSSIA: TAA-Kullman and Raĭtviĭr 61115, Raĭtviĭr 42584, 43431. UKRANIA: BPI-V.P. et L.J. Savicz et A.J. Bjeljajeva s.n., 15-VII-1924.

VENEZUELA: CUP 4472; NY-Dumont-VE 7 (= CUP-VZ 4516), 38 (= CUP-VZ 4529), 252 (=CUP-VZ 4528), 114 (= CUP-VZ 4525), 145 (= CUP-VZ 4533), 247 (= CUP-VZ 4517), 454 (= CUP-VZ 4521), 511 (= CUP-VZ 4532), 523 (= CUP-VZ 4534); 794 (= CUP-VZ 4524), 795 (= CUP-VZ 4518); 798 (= CUP-VZ 4526), 1330 (= CUP-VZ 4515), 1356 (= CUP-VZ 4522), 1427 (= CUP-VZ 4520), 2348 (= CUP-VZ 4523; NY-Wurdack 31431, 31518.

LOCALITY UNKNOWN: Neotype specimen of *Peziza aeruginosa* Pers. per Pers. : Fr., UPS-Fries 287, in lignis *Betula*, (locality unknown), Kalchbrenner, (no date) (= CUP 51738).

Notes: This species is easily distinguished by the size of its ascospores and its granularly roughened tomentum hyphae. I have examined several specimens which on casual observation appear not to possess any such tomentum hyphae, but which have beyond question ascospores typical of this species. Careful examination especially at the margin of the apothecia always shows that tomentum hyphae are present; hence, if there is any question as to the presence of tomentum hyphae the observer is urged to examine the apothecial margin. This species appears to be somewhat more southern in its distribution (on the basis of numbers of specimens examined), but definitely overlaps the ranges of its closest relative, *Chlorociboria aeruginascens*.

Gamundí (1962) reports the presence of "pelos himeniales" for this species. I have examined the same specimens in which she indicated these hymenial hairs occur, but have been unable to locate any such structures either in squashed or sectioned material.

2. CHLOROCIBORIA AERUGINASCENS (Nyl.) Kan. ex Ram., Korf & Bat., Mycologia 49: 858. 1958, subsp. aeruginascens.

=[*Peziza viridissima, petiolata, scypho infundibuliformi* Hall., Hist. Stirp. Indig. Helvetiae Inch. 2: 131. 1768.]
    ≡[*Peziza viridis stipitata, viridis, arborea* Wigg., Primit. Fl. Holsaticae p. 106. 1780.]
=[*Elvela aeruginosa, minima pileo difformi viridissima* Oed., Flora Danica 3(9): 7, Tab. 534, fig. 2. 1770.]
    ≡[*Helvella aeruginosa* Oed. ex With., Arrangement Brit. Plants, ed. 3, p. 341. 1796.]
    ≡ *Helvella aeruginosa* Oeder per Purton, App. Midl. Fl. p. 258. 1821. (!!)
    ≡ *Helotium aeruginosum* (Oed. per Purton) Gray, Nat. Arrangement Brit. Plants p. 661. 1821.
    ≡ *Chlorosplenium aeruginosum* (Oed. per Purton) de Not., Comment. Soc. Critt. Ital. 1: 376. 1864.
=[*Merulius aeruginosa* Schum., Enum. Pl. Saell. p. 371. 1803.] (!!)
= *Peziza aeruginosa* Pers. per Pers. : Fr. [var.] b. *subgrisea* Fr., Syst. Mycol. 2(1): 130. 1822.
≡ *Peziza aeruginascens* Nyl., Not. Sällsk. Fauna Fl. Förh. 10: 42. 1869. (!!)
    ≡ *Chlorosplenium aeruginascens* (Nyl.) Karst., Not. Sällsk. Fauna Fl. Förh. 11: 233. 1870 (ut "aeruginescens," Seaver, Mycologia 28: 391. 1936, pro synon. et lapsus calami).

≡ *Helotium aeruginascens* (Nyl.) Schroet., Krypt.-Fl. Schles. 3^2(1): 83. 1893.
≡ *Chrysosplenium aeruginascens* (Nyl.) Karst. in Allescher, Ber. Bot. Vereines Landshut 15: 82. 1898 (lapsus calami).
≡[*Chlorociboria aeruginascens* (Nyl.) Kanouse, Mycologia 39: 641. 1947 (generic name not validly published).]
≡[*Chlorociboria aeruginosa* "(Oed. ex Gray) Seaver" var. *aeruginascens* (Nyl.) Bellemère, Bull. Soc. Mycol. France 83: 585. 1968 (basionym not cited).]
= *Chlorosplenium indicum* Singh (ut errore "Dumont, Korf & Singh"), Trans. Brit. Mycol. Soc. 63: 293. 1974. (!)

MISAPPLIED NAMES:

Peziza aeruginosa Pers. per Pers., Myc. Eur. 1: 291. 1822 : Fr., Syst. Myc. 2(1): 130. 1822 (pro parte non typica).
≡[*Chlorociboria aeruginosa* (Pers. per Pers. : Fr.) Seaver (ut "(Oed.) Seaver"), Mycologia 28: 391. 1936 (pro parte non typica; genus not validly published).]
≡ *Chlorociboria aeruginosa* (Pers. per Pers. : Fr.) Seaver ex Ram., Korf & Bat. (ut "(Oed. ex Gray) Seaver") Mycologia 49: 859. 1958 (pro parte non typica).

(Figs. 10-14, 24)

Apothecia: superficial, solitary to gregarious, excentrically to infrequently centrally stipitate, frequently with several apothecia arising from a darkly pigmented and irregularly shaped fundament or "stromatic mass" which in section has a medulla of hyaline to light-green textura intricata and a cortex of tightly compacted and darkly aeruginous textura intricata, gymnocarpic in development.

Disc: < 7 mm in diam, cupulate to spathulate when young, becoming expanded-infundibuliform in fully mature specimens, color varying from light orange-yellow to concolorous with the receptacle to whitish-pale-green (Amber Yellow to Benzol Green to Pale Glaucous-Green), on drying becoming slightly darker than that in the fresh state.

Receptacle: glabrous or finely tomentose, bluish-aeruginous (Benzol Green to Sorrento Green), lower portion furrowed and rugose especially upon drying.

Stipe: < 6 × 1.0-1.5 mm, concolorous with the receptacle, on breaking showing a cortex and medulla both concolorous with the receptacle.

Hymenium: (45-) 60-85 (-100) µm high, hyaline to aeruginous, often with portions of the hymenium being more darkly pigmented.

Asci: cylindric-clavate, with a long tapering stalk, (40-) 50-65 (-75) × 3-4 (-5) µm (mean of collections 54 × 4 µm), strongly J+, 8-spored, wall at apex 1.0-1.5 µm thick, 0.25-0.5 µm thick along the sides of the ascus, arising from repeating croziers.

Ascospores: irregularly biseriate, unicellular, fusiform to elliptic-fusiform, hyaline or with light green contents with bipolar guttules, smooth-walled, 5-7 (-10) × 1.0-1.5 (-2.4) µm (mean of collections 6 × 1.5 µm).

Paraphyses: filiform, blunt at the apex, hyaline, septate, branching near the base, (1.0-) 1.5 (-2.0) µm in diam, scarcely extending beyond the asci.

Subhymenium: (5-) 10-25 (-40) µm thick, of gelatinized, hyaline to aeruginous textura intricata, hyphae 1-2 (-3) µm in diam.

Medullary Excipulum: of gelatinized, thin-walled, loose to tightly compacted textura intricata, with hyaline to light green contents (an occasional specimen dark green), hyphae sympodially branched, 1.5-3 (-4) µm in diam.

Ectal Excipulum: 30-75 µm thick, of hyaline to aeruginous hyphae forming a single layer of gelatinized textura intricata to textura epidermoidea, dark aeruginous in fully mature apothecia, ectal hyphae giving rise to few to numerous, coiled or sometimes straight, smooth-walled tomentum hyphae, often with tomentum hyphae so numerous that they appear to form an outer layer of the ectal excipulum, tomentum hyphae 1.0-1.5 (-2) µm in diam.

Cultural Characters: Very slow growing on agar (PDA), producing an aeruginous colony from which hyphae penetrate into the agar and ramify through it. No conidia produced. Agar appearing dark aeruginous due to leaching of aeruginous pigment into media. Hyphae 1.0-2.5 µm in diam, frequently branched, highly guttulate, thin-walled, with hyaline to light green contents. Two of my cultures are on deposit with the American Type Culture Collection as ATCC 24028 (= specimen CUP 51683) and ATCC 24029 (= specimen CUP 51676).

Habitat: on decorticated and decayed wood; collected on *Abies, Alnus, Betula, Carpinus, Cornus, Crataegus, Fagus, Fraxinus, Pasania, Picea, Pinus, Podocarpus, Populus, Salix, Sorbus, Tilia, Tsuga, Ulmus, Quercus* and unidentified wood.

Range and Seasons of Fructification: world-wide; collections from North & South America, Europe, Scandinavia, India, Japan, China, Philippines, Union of Soviet Socialist Republics; Spring, Summer, and Autumn.

Name: from Latin, "aeruginosus," deep-green, with a mixture of blue, + "-ascens," Latin suffix, becoming; perhaps referring to the fact the substrate becomes aeruginous.

Lectotype Locality: Ostrobottniae australis, Kuortane, northwest Finland.

Lectotype Specimen: (substrate unknown), Ostrobottniae australis, Kuortane, P. A. Karsten, 28. VII. 1859, det. W. Nylander, H-Karsten s.n. (= CUP 52630).

Illustrations: Oeder, Fl. Danica, Tab. 534, fig. 2. 1770 (ut *Elvela aeruginosa*); Holmskjøld, Beata ruris otia fung. dan. 2: Pl. 12. 1799 (ut *Peziza aeruginosa*); Greville, Scot. Crypt. Fl. 5: Pl. 241. 1827 (ut *Peziza aeruginosa*); Tulasne & Tulasne, Sel. Fung. Carp. 3: Pl. 20, figs. 15-19. 1865 (ut *Chlorosplenium aeruginosum*)!; Lindau, Naturl. Pflanzen-fam. I 1*: 196, fig. 155 H-J. 1897 (ut *Chlorosplenium aeruginosum*); Migula, Kryptog.-Flora in Thomé's Fl. Deutschl. 3(3^2): Pl. 169, figs. 5-6. 1913 (ut *Chlorosplenium*); Akai, Bot. & Zool. 2: 835, fig. 2. 1934 (ut *Chlorosplenium*); Kobayasi in Asahina, Nippon inkwasyokubutu Dukan, Pl. 141, figs. 3-5, 1939 (ut *Chlorociboria aeruginosa*); Dennis, Mycol. Pap. 62, fig. 39. 1956 (ut *Chlorociboria aeruginosa*); Dennis, Brit. Cup Fungi Pl. 15, fig. F. 1960 ; Ramamurthi, Korf & Batra, Mycologia 49: 856, fig. 2. 1958; Korf, Sci. Rep. Yokohama Natl. Univ. Sect. 2, Biol. Sci. 7: 25, figs. 8-9, 1958 (ut *Chlorociboria* et ? Tax. sp. 2)!; Bellemère, Bull. Soc. Mycol. France 83: 584, fig. 68, A-H. 1967 (ut *Chlorociboria aeruginosa*)!; Dennis, Brit. Ascomycetes, Pl. 18, fig. F. 1968 (ut *Chlorosplenium*).

Exsiccati: Berkeley, British Fungi Exs. No. 281 (ut *Peziza aeruginosa*) FH; Jaczewski, Komarov & Tranzschel, Fungi Rossiae Exs. No. 194 (ut *Chlorosplenium*) BPI, CUP-D 4534 (76-16); Jaap, Fungi Selecti Exs. No. 457 (ut *Chlorosplenium*) BPI; Karsten, Fungi Fenniae No. 151 (ut *Chlorosplenium aeruginosum*) FH; Phillips, Elvellacei Britannici No. 86 (ut *Helotium aeruginosum*) FH, CUP-D 11088 (76-24); Rabenhorst, Fungi Europaei No. 1310 (ut *Peziza aeruginosa*) FH, CUP; Rehm, Ascomyceten Exs. No. 408 (ut *Chlorosplenium*) CUP-D 4885 (76-18); Saccardo, Mycotheca Italica No. 333 (ut *Chlorosplenium aeruginosum*) BPI; Smarods, Fungi Latvici Exs. No. 771 (ut *Chlorosplenium aeruginosum*) CUP 33049; Wilson & Seaver, Ascomycetes and Lower Fungi No. 78 (ut *Chlorosplenium aeruginosum*) CUP, CUP-D 10000 (76-76).

Excluded Exsiccati: Rick, Fungi Austro-Americani No. 6 issued as *Chlorosplenium aeruginascens* is *Chlorociboria aeruginascens* subsp. *brasiliensis;* Ibid., No. 6a, issued as *Chlorosplenium aeruginascens* is *Chlorociboria aeruginosa.*

Specimens Examined: U.S.A. - ALASKA: BPI-Baxter s.n., Aug. 24, 1936; NY-Cooke 42266. CALIFORNIA: BPI-McMurphy s. n., Jan. 14, 1924; Parks 2687, 5210, s.n., 31. Aug. 1960. COLORADO: CUP-D 6668 (76-70). GEORGIA: CUP 51773. IDAHO:

BPI-Slipp 1072; CUP 52636; OSC 25794. IOWA: CUP-D 470 (76-30). MAINE: CUP-D 8981 (77-123). MASSACHUSETTS: CUP 51845; CUP-D 4536 (76-52). MICHIGAN: C-Povah s.n., Aug. 20, 1930; CUP 51679, 51689, 51691, 51693, 51695, 51698, 51700, 51705, 51765, 51766, 51768, 51775, 51776, 51779, 51780, 51791, 51800-825. MINNESOTA: NY-Cooke 43493, 43623. NEW HAMPSHIRE: FH-no collector, s.n., Sept. 93. NEW JERSEY: CUP 51836; CUP-D 4537 (76-53). NEW YORK: BPI-Seaman s.n., Buffalo; CUP 11858, 43235, 51674, 51676-78, 51683-85, 51692, 51694, 51696, 51697, 51699, 51706, 51767, 51828-29, 51830-35, 51844, 51848, 51850; CUP-D 9549 (77-125), 9554 (77-126); CUP-LG 354; R.P.K. 782, 53-102. NORTH CAROLINA: BPI-Miller s.n., Aug. 18, 1933; CUP 37276, 51867, 51770, 51851. OHIO: CUP-D 1231 (76-4). OREGON: OSC 25793, 27978, 30119. TENNESSEE: CUP 51676, 51686, 51688, 51690. VERMONT: CUP-D 9008 (77-124). WASHINGTON: BPI-Maas 1778, Smith 2576; OSC 25797. WISCONSIN: CUP 51682, 51838, 51839, 51840-43.

BULGARIA: TAA-Parmasto 19299.

CANADA - BRITISH COLUMBIA: BPI-Mounce 7306; OSC 25795; V-collector unknown, s.n., Oct. 6, 1965. ONTARIO: BPI-Cain s.n., Sept. 6, 1933, Cain 41241, Elliott 89367, Jackson 1830, Senn 5340; C-Elliott 89367; CUP 51921, 52708; R.P.K. 3932. QUEBEC: BPI-Emmons s.n., Aug. 24-26, 1938.

CHINA: BPI-Deng 501, Teng 3371.

CUBA: FH-Wright, Fungi Cubenses Wrightiani No. 625 [= CUP-D 3561 (76-47)].

CZECHOSLOVAKIA: BPI-Pilat s.n., VII-1934.

DENMARK: C-Dissing s.n., 10-8-1963, F. et W. s.n., Oct. 1908, Hansen s.n., 30.8.1965, Kongr. s.n., 28.VIII.1969, Lind s.n., 12-9-1904, Milan s.n., 13.8.1965, Mortensen s.n., 19 Oct. 1884, Raunkjaer s.n., April 1912, Rostrup s.n., 17/79, 3/5 81, 12/ 81, 6/9 81, 21/10 95, 27-10. 1895, 4/ 03, Wieze s.n., Sjaellands; CP-Åmose s.n., 26.11.1961, Fussingø s.n., 3.10.1952, Hind s.n., 30/10 1911, NB[uchwald] s.n., 1955, NB[uchwald] s.n., 18.9.1961, Rostrup s.n., 29.9.89, 10. 1895, 20.5.91, Stenskov s.n., 8. 1905.

ENGLAND: BPI-Shear s.n., Sept. 18, 1930; CUP-D 146 (76-28), 147 (76-29).

FINLAND: Ostrobottniae australis, Kuortane, (substrate unknown), P. A. Karsten, 28. VII. 1859, det. W. Nylander ut *Peziza aeruginascens*, H-Karsten Herb., s.n. (= CUP 52630), lectotype specimen (designated here) of *Chlorociboria aeruginascens* subsp. *aeruginascens* and neotype specimen (also designated here) of *Helvella aeruginosa* Oeder per Purton).

GREENLAND: C-Lange s.n., 28/9 1946.

INDIA: CUP-IN 468 (= Singh 3492), paratype specimen of *Chlorosplenium indicum* Singh.

JAPAN - HOKKAIDO: CUP-JA 446, 2635, 2659. HONSHU: CUP-JA 1542, 1554, 1555, 1594; R.P.K.-JA 1686. KYUSHU: CUP-JA 331, 346, 357, 400.

NETHERLANDS: C-Schumacher No. 1919, (locality, collector and date unknown), [orig. descr.: in trunco subputrido (Charlottenlund) Octob.], holotype of *Merulius aeruginosa.*

PHILIPPINES: CUP-SA 1529.

SWEDEN: BPI-Haglund s.n., 30/8 1901, Nannfeldt s.n., 10.VIII-1928; C-Haglund s.n., 24/8 1910; CUP-D 28 (76-27), 2516 (76-3), 9915 (76-22); UPS-Fries, lignum Småland: Femsjö, 1856, ut *Helotium aeruginosum,* det. J.A. Nannfeldt (= CUP 51735).

UNION OF SOVIET SOCIALIST REPUBLICS - ARMENIA: TAA-Raĭtviĭr 43130 (= R.P.K. 3332). GEORGIA: TAA-Parmasto 16854, Răitviĭr 44858. KAMCHATKA: TAA-Parmasto 12493. KURIL ISLANDS: TAA-Parmasto 12186. RUSSIA: BPI-Jaczewski s.n., 1895; TAA-Maasik 19623, Parmasto 7231, 8092, 14381, 15359, 16005, 16191, Kullman & Raĭtviĭr 61197, 61252, 61255, Raĭtviĭr 42258, 42292, 42307, 42550, 42521, 42601, 42750, Remm 44362. UKRANIA: BPI-V.P. et L.J. Savicz et Z.J. Bjeljajeva s.n., 15-VII-1924; H-Karsten s.n., ad Salic., Rossia, Kola, P. A. Karsten, 27.VII.1861, det. W. Nylander (=CUP 52631), syntype (lectoparatype, designated here) specimen of *Peziza aeruginascens* Nylander.

VENEZUELA: NY-Dumont-VE 76 (= CUP-VZ 4527), 150 (= CUP-VZ 4519), 157 (= CUP-VZ 4531), 406 (= CUP-VZ 4530), Morillo 1520, Wurdack 34156.

LOCALITY UNKNOWN: L-Persoon, L-910,261-154, (locality, date and collector unknown) ut *Peziza aeruginosa* (= CUP 51759).

Notes: This species is distinguished by its small sized fusoid spores 5-7 (-10) × 1.0-1.5 (-2.4) μm, and by its tomentum hyphae which are smooth and usually coiled. I have examined several specimens which on casual examination seem to lack tomentum hyphae. Careful examination shows that tomentum hyphae typical of this species are present, but not as numerous as is the usual case. This species often produces several apothecia from the same fundament, a feature never found in *Chlorociboria aeruginosa,* with which it is often confused.

I have examined the specimen from Japan (CUP-JA 446) which Korf (1958: fig. 9) illustrated and which has ascospores 6-10 × 1.5-2 μm and a mean size of 8 × 1.5 μm. While these ascospores are clearly within the range exhibited by *C. aeruginascens,* the mean size is somewhat larger than the 6 × 1.5 μm exhibited by other collections I have observed.

This specimen is in all other respects *C. aeruginascens*, and until more information concerning the role of biological and environmental factors are at hand in regard to this species, I choose not to designate it a distinct taxon.

Schweinitz's species *Cantharellus viridis* Schw. [≡ *Chlorosplenium viride* (Schw.) Morgan] could provide an older epithet for *C. aeruginascens* if the type or an authentic specimen could be located (cfr. the discussion in Part I of this paper, MYCOTAXON 1(2): 103. 1974).

3. CHLOROCIBORIA AERUGINASCENS (Nyl.) Kan. ex Ram., Korf & Bat. subsp. brasiliensis (Berk. & Cooke) Dixon, *comb. et stat. nov.*
≡ *Chlorosplenium brasiliense* Berk. & Cooke, J. Linn. Soc., Bot. 15: 363. 1876. (!!)
= *Chlorosplenium puiggarii* Speg., Anales Soc. Ci. Argent. 12: 89. 1881. (!!)
= ? *Chlorosplenium microspermum* Henn., Hedwigia 41: 26. 1902.

(*Fig. 25*)

In all respects similar to *Chlorociboria aeruginascens* subsp. *aeruginascens* except asci (35-) 41-49 × 3-4 µm (mean of collections 43.5 × 3.5 µm) and ascospores 3.0-5.5 (-6) × 1-1.5 µm (mean of collections 4.9 × 1.3 µm).

Habitat: on decayed wood.

Range and Seasons of Fructification: collected in Brasil, Jamaica, and Venezuela; Autumn and Winter.

Name: Brasil + -ensis; referring to the type locality.

Type Specimen: (substrate unknown), R. Tapajos, Brazil, Trail No. 29, (date unknown), K (= CUP 52720)

Illustrations: none.

Exsiccati: Rick, Fungi Austro-Americani No. 6 (ut *Chlorosplenium aeruginascens*) BPI.

Specimens Examined: BRASIL: (substrate unknown), R. Tapajos, Brazil, Trail No. 29, (date unknown), K (= CUP 52720), holotype of *Chlorosplenium brasiliense;* BPI-Noak s.n., 12. 1896 [= CUP-D 6834 (76-20)], Rick s.n., 1924, Rick 107; FH-Rick s.n. (date unknown); LPS 24436, (substrate unknown), Apiahy, Brazil, J. Puiggari No. 1490, 1556, V/1881, holotype specimen of *Chlorosplenium puiggarii*; isotypes of same, BA (= CUP 51749), BPI (= CUP 51714).

JAMAICA: K-Welden 420 (= BPI-Welden 420).

VENEZUELA: K-Dennis 1195, 1307A.

Notes: This subspecies has been recognized at least twice in the literature at the specific rank and possibly a third time (by Hennings as *Chlorosplenium microspermum*). I have examined several specimens of this subspecies and feel that while they exhibit consistently smaller asci and ascospores, in all other respects they have the same gross and microanatomical features as does *C. aeruginascens* subsp. *aeruginascens*.

4. Chlorociboria argentinensis Dixon, *spec. nov.*

(Figs. 22-23, 26)

Apothecia superficialia, solitaria vel gregaria, saepe pluribus ab enatis fundamento ("massa stromatica") obscure pigmentifero vel irregulariter formato. Discus usque ad 4 mm diametro, cupulatus in speciminibus juvenibus, planescense in speciminibus magis maturis, dilutae-aeruginosae ubi dulces, atro-aeruginosescens ubi aridae et non recepindum diluta coloratio qui humecto in aquam. Margines disci incurvus ubi aridae. Receptaculum glabrum, papulosum (pustulae atro-aeruginosae), portionis rugulosae imprimis ubi aridae. Stipes centralis vel leviter excentricus, usque ad 0.5-1.5 × 0.5-1 mm, concolor cum receptaculo, valde papulosus, ubi fractus aeruginosus cortex et albida medulla constitutum. Hymenium (70-) 75-90 (-95) μm altum, hyalinum vel aeruginosum frequenter cum portionis plurae obscure pigmentiferae. Asci octospori, cylindraceo-clavati, basaliter longe angustati, (61-) 70-82 (-95) × (3.5-) 4.0-5.0 (-5.5) μm (modorum collectionis 79.0 × 4.5 μm), ad apicem inoperculati, poro valde jodi ope azurescente, tunica in apice 1.0-1.5 μm crassa, secus latera 0.25-0.5 μm crassa. Ascosporae irregulariter biseriatae, unicellularis (aliquando cum uno submedio septo), fusoideo-ellipticae, hyalinae vel cum viride quod intus continetur, biguttulatae, tunica laevis, (7-) 9.0-10.2 (-11) × 1.7-2.0 μm (modorum collectionis 9.6 × 1.9 μm). Paraphyses septatae, filiformes, hyalinae, ramificans prope basem, (1.0-) 1.5 (-2.0) μm diametro. Subhymenium 10-30 (-40) μm crassum, ex textura intricata, septatae, gelatinosa, hyalina vel atro-aeruginosa formatum, hyphis 1-3 μm diametro. Excipulum medullare ex textura intricata crasse tunicata laxa vel stricta formatum, quod intus continetur diluta vel atro-aeruginosa, sympodialiter ramosis, hyphis 2.5-5 μm diametro. Excipulum ectale 45-90 μm crassum, ex textura intricata, gelatinosa, atro-aeruginosa formatum, in speciminibus perfecte maturis ex textura angularis vel textura epidermoidea formatum, non hyphis tomenti formati loco ad punctum secus ectale conicus tumulus ex textura angulari vel globulosa obscure pigmentifera et granulata fere sub angulo 90° ab superficie apotheciorum abeuntes edente. Habitat in ligno carioso, Tucumania, America Meridionali.

Apothecia: superficial, solitary to gregarious, frequently with several apothecia arising from a darkly pigmented and irregularly shaped fundament or "stromatic mass," which in section has a medulla of hyaline to light-green textura intricata and a cortex of tightly compacted and darkly aeruginous textura intricata, centrally stipitate to slightly excentrically stipitate.

Disc: < 4 mm in diam, cupulate in young specimens, becoming plane in more mature specimens, pale blue-green (Malchite Green to Deep Glaucus Green) when fresh (according to Gamundí, 1962), becoming aeruginous-black (Dusky Dull Green to Black) upon drying, and not recovering the lighter coloration when moistened with water, margins of disc enrolling to the point of touching when dry.

Receptacle: glabrous, aeruginous when fresh, drying to a darker aeruginous (Dusky Bluish Green), lower portion furrowed and rugose especially upon drying, with dark aeruginous pustules.

Stipe: 0.5-1.5 × 0.5-1.0 mm, concolorous with the receptacle, heavily pustulate, on breaking showing an outer aeruginous cortex with a whitish medulla.

Hymenium: (70-) 75-90 (-95) μm high, hyaline to aeruginous, often with portions of the hymenium being more darkly pigmented.

Asci: cylindric-clavate, with a long tapering stalk, (61-) 70-82 (-95) × (3.5-) 4.0-5.0 (-5.5) μm, (mean of collections 79.0 × 4.5 μm), strongly J+, 8-spored, rounded to subconic at the apex, wall at the apex 1.0-1.5 μm thick, 0.25-0.5 μm thick along the sides.

Ascospores: irregularly biseriate, unicellular (an occasional spore sub-median 1-septate), fusiform to elliptic-fusiform, hyaline or with light green contents, with bipolar guttules, smooth-walled, (7-) 9.0-10.2 (-11) × 1.7-2.0 μm (mean of collections 9.6 × 1.9 μm).

Paraphyses: filiform, blunt at the apex, hyaline, septate, branching near the base, (1.0-) 1.5 (-2.0) μm in diam, scarcely extending beyond the asci.

Subhymenium: 10-30 (-40) μm thick, of gelatinized hyaline to dark aeruginous textura intricata, hyphae 1-3 μm in diam.

Medullary Excipulum: of gelatinized, thick-walled, loose to tightly compacted textura intricata, contents light to dark aeruginous, hyphae sympodially branched, 2.5-5 μm in diam.

Ectal Excipulum: 45-90 μm thick, of dark aeruginous hyphae forming a layer of gelatinized textura intricata which in fully mature specimens becomes textura angularis to textura epidermoidea, no tomentum hyphae present, but at points conical mounds of heavily pigmented and granulated textura angularis to textura globulosa project almost perpendicularly from the flanks of the apothecia.

Habitat: on decorticated and decayed wood; collected on *Nothofagus dombeyii* and *Nothofagus* sp., and unidentified wood.

Range and Seasons of Fructification: collected only in Argentina; Spring, Summer and Autumn.

Name: Argentina + -ensis; referring to the type locality.

Type Specimen: (substrate unknown), ARG., R. Negro, P. N. N. Huapí, L. Frías, camino a Paso de las Nubes, C. Pujals - I. Gamundí, 24/IV/1958, BA (= CUP 52726).

Illustrations: Gamundí, Darwiniana 12: Pl. 5, figs. 8-13. 1962 (ut *Chlorosplenium aerugineum*).

Exsiccati: none.

Specimens Examined: ARGENTINA: BA-Dicke s.n., 24/XI/1966; BA-20042, 20359, 20400, 20620 (= R.P.K. 2896), 20929, 21090, 21099, 21113, 21152, 21179, 21201, 21223, 21265, 21354, 21375, 21396, 21400, 21585, 21636, Gamundí s.n., 31/III/1963.

Notes: This species is distinguished from other species of *Chlorociboria* by its dark aeruginous hymenium which becomes blackish aeruginous on drying and does not recover its lighter coloration even when rehydrated in water, its fusoid spores which are 9.0-10.2 × 1.7-2.0 µm and by its ectal excipulum which forms conical mounds of hyphae which are heavily pigmented and granulated and project almost perpendicularly from the flanks of the apothecia.

Gamundí (1962) has an excellent description of this species (as *Chlorosplenium aerugineum*) and reports the presence of "pelos himeniales." In her discussion and illustration of these hymenial hairs, she indicates they are very similar to the type of tomentum hyphae arising from the ectal excipulum of *Chlorociboria aeruginosa*. I have examined these same specimens but have been unable to locate any such structures in either squashed or sectioned material.

5. Chlorociboria omnivirens (Berk.) Dixon, *comb. nov.*

≡ *Peziza omnivirens* Berk., in J. D. Hooker's Bot. Ant. Voy. H. M. Disc. Erebus & Terror, II: Flora Tasmaniae 2: 275. 1860. (!!)

≡ *Chlorosplenium omnivirens* (Berk.) Cooke, in Mueller's Fragmenta Phytog. Austr. 11 (Suppl. 6): 100. 1880.

(Figs. 21, 29)

Apothecia: superficial, solitary to gregarious, never with several apothecia arising from the same fundament or "stromatic mass," centrally to slightly excentrically substipitate to stipitate, gymnocarpic in development.

Disc: < 4 mm in diam, cupulate to convex-plane, color varying from orange-yellow (Capucine Yellow) in younger specimens, becoming greenish-black (Dusky Dull Green to Black) in older specimens, edges of the disc not enrolling on drying.

Receptacle: glabrous, pustulate, aeruginous to dark aeruginous (Sorrento Green to Dark Viridian Green) when rehydrated, becoming darker aeruginous green to black upon drying, often vertically ribbed or rugose, especially upon drying.

Stipe: 0.5-1.5 × 0.5-1.0 mm, concolorous with the receptacle, pustulate, often more pustulate than the receptacle, on breaking showing an outer aeruginous cortex and a whitish medulla.

Hymenium: (85-) 90-120 (-160) µm in height, hyaline to dark aeruginous, often with portions of the hymenium becoming more darkly pigmented.

Asci: cylindric-clavate, with a long tapering stalk, (65-) 76-90 (-95) × (6.5-) 7-8.5 (-9.0) µm (mean of collections 76.5 × 7.0 µm), strongly J+, 8-spored, wall at apex 2-3 µm thick, 0.5-1.0 µm thick along the sides of the ascus, arising from repeating croziers.

Ascospores: irregularly biseriate, unicellular to submedian 1-septate, fusiform-elliptic, hyaline or with light green contents, prominently biguttulate and/or with several smaller guttules, (11-) 14-18 (-20) × 3-4 µm (mean of collections 16 × 3.5 µm), spores frequently germinating in the ascus by unipolar or bipolar germ tubes, with globose to subglobose microconidia 1.0-2.5 µm in diam frequently being produced at the ends of the germ tube and floating free in the mounting media.

Paraphyses: filiform, blunt at the apex, hyaline, septate, branching near the base, 1.5-2.0 µm in diam, scarcely extending beyond the asci.

Subhymenium: 10-25 (-35) µm thick, of hyaline to aeruginous textura intricata, hyphae 1.5-3 µm in diam.

Medullary Excipulum: of gelatinized, thin-walled, loose to tightly compacted textura intricata (in the type specimen the hyphae are more highly gelatinized than in the Japanese material), hyphae sympodially branched, (2-) 3-4 (-5) µm in diam.

Ectal Excipulum: 45-60 µm thick, of gelatinized, heavily pigmented textura intricata to textura angularis, no tomentum hyphae present, but at points along the flanks conical mounds of heavily pigmented and granulated textura angularis to textura globulosa project almost perpendicularly.

Habitat: decayed and decorticated wood; collected on

Thuja standishii and unidentified wood.

Range and Season of Fructification: Japan and Tasmania; Autumn.

Name: from Latin, "omnino," adv., entirely, + "virens," green; referring to the coloration of the apothecia.

Type Locality: Tasmania.

Type Specimen: (substrate unknown), Tasmania, Archer s.n., (date unknown), K-Berkeley (= CUP 51757).

Illustrations: Korf, Sci. Rep. Yokohama Natl. Univ. Sect. 2, Biol. Sci. 7: 25, fig. 6 (ut Tax. sp. I) et 27, figs. 11-12 (ut Tax. spp. IV et V)!.

Exsiccati: none.

Specimens Examined: JAPAN - HONSHU: CUP-JA 31, 52, 1603. KYUSHU: CUP-JA 347. YAKU ISLAND: CUP-JA 2079.

TASMANIA: K-Berkeley Archer s.n., holotype of *Peziza omnivirens* (= CUP 51757).

Notes: This species is redescribed here after 115 years. It is distinguished from *C. aeruginosa,* its closest relative, by its larger asci and ascospores and its conical mounds of hyphae which are heavily pigmented and granulated and project nearly perpendicularly from the flanks of the apothecium. It tends to be somewhat more substipitate than stipitate, but I have observed specimens which are definitely stipitate.

THE PHIALOCONIDIAL STATES OF CHLOROCIBORIA

Tulasne and Tulasne (1865) were the first workers to recognize the connection of *Dothiorina tulasnei* (as *Sphaeria moriformis* Tode var. [unnamed]) to a perfect state species of *Chlorociboria.* They discussed and illustrated very accurately the imperfect state and gave detailed measurements of ascospores and asci which agree with *Chlorociboria aeruginascens* subsp. *aeruginascens.* Saccardo (1884) transferred Tulasne and Tulasne's unnamed variety to the genus *Dothiorella* as *D. tulasnei* and stated, as had Tulasne and Tulasne, that it was a spermagonial state.

Von Höhnel (1911) erected a new genus, *Dothiorina,* to accommodate *Dothiorella tulasnei,* stating, "*Dothiorella* Sacc., 1880, ist im heutigen Umfange eine Mischgattung" and "Die Gattung wurde in Michelia, 1880, II Bd., p. 5, aufgestellt und hier als Typus *D. pyrenophora* (Berk.) Sacc. angeführt." Von Höhnel also goes on to say in regard to *D. pyrenophora* that, "Diese Art wird aber in Syll. Fung., III, p. 380, als *Botryodiplodia* bezeichnet, da die Sporen nach Cooke braun und zweizellig sind."

I have seen several specimens of *Dothiorina tulasnei* collected separately and collections of this species collected with both *C. aeruginascens* subsp. *aeruginascens* and *C. a.* subsp. *brasiliensis*, but never have I observed the two fungi on the same substrate in such close proximity to each other that I could be convinced that they grew from the same mycelia and were in fact different states of the same fungus.

I am extremely indebted to Dr. André Bellemère, Laboratoires de Sciences Naturelles, St.-Cloud, who was kind enough to send me a microphotograph of a specimen collected on "bois de l'Hautil près de Triel-sur-Seine, non loin de Paris, où il a été trouvé le 17 avril 1960 (N° 276)," which clearly shows that there are mycelial connections between these two states.

Berthet (1964b) described the cultural characteristics he noted in cultures derived from germinated ascospores. It is not possible with any certainty to deduce whether the ascospores were from an apothecium of *C. aeruginascens* or *C. aeruginosa* from his description. His illustrations and discussion of the sporogenous hyphae he obtained in culture (Berthet, 1964a) and the spores they produce agree with observations I have made on phialides produced in the pycnidial chambers of *Dothiorina tulasnei*. I have been successful in obtaining cultures of *C. aeruginascens* from germinated ascospores which agree with Berthet's observations in all respects except unlike his cultures, my isolates do not produce phialoconidia at either 4° C or 20-25° C. Brefeld (1891) also illustrated mycelia and spores which he obtained in culture, but lack of sterile and pure culture techniques during the late eighteen hundreds and the poor quality of Brefeld's illustrations makes it uncertain if he was dealing with a pure culture. Berthet (1964a) observed that the phialoconidia produced in his cultures germinated easily. This fact would indicate that *Dothiorina tulasnei* is an imperfect state and not a spermatial state as indicated by Tulasne and Tulasne (1865) and Saccardo (1884). Today *D. tulasnei* would be placed in the Sphaeropsidales, Zythiaceae (= Nectrioidaceae).

The only other species that has been added to *Dothiorina* is *Psilonia discoidea* Berk. & Broome. Von Höhnel (1925) evidently made this transfer on the basis of Rabenhorst, Fungi Europaei Exs. No. 1075. I have examined this collection and find that it is dissimilar to *D. tulasnei*. The stroma is very effuse, more carbonaceous, black with yellow pycnidia, and produces dark brown-walled, frequently septate hyphae which ramify throughout the substrate. The spores produced are also phialoconidia, 3-4 × 2 µm, but the phialophores are not branched and do not produce flask-shaped phialides. Von Höhnel felt that *D. discoidea* was the imperfect state of a "*Helotium*, vielleicht *Helotium ferrugineum* (Schum.)". Hence, while I am not certain to which genus *D. discoidea* belongs, I believe it is not congeneric with *D. tulasnei*, and that von Höhnel was over-influenced by the parallel nature of the hyphae between the pycnidial chambers in making *D. discoidea* a member of his genus *Dothiorina*.

1. DOTHIORINA TULASNEI (Sacc.) v. Höhn., Akad. Wiss. Wien Sitzungsber., Math.-Naturwiss. Kl., Abt. 1, 120: 86. 1911.
   ≡[*Sphaeria moriformis* Tode var. (unnamed), Tul. & Tul., Sel. Fung. Carp. 3: 187. 1865.]
   ≡ *Dothiorella tulasnei* Sacc., Syll. Fung. 3: 39. 1884.

(Figs. 15-18, 27)

Fructification: a subspherical to moriform stroma < 2 mm in diam, often with several stromata coalescing, superficial to erumpent through the bark, when rehydrated dark aeruginous and sub-fleshy, drying blackish aeruginous to almost black, and on drying becoming somewhat more carbonaceous, producing numerous oval to pyriform pycnidial chambers, 30-70 µm wide at their widest point, which are lined with numerous, short, cylindrical, inflated, frequently flask-shaped phialides 5-11 × 1.5-2.5 µm, produced singly or in groups of two, three or four on branching phialophores. Phialophores 1.5-3 µm in diam, with hyaline to light green contents and heavily granulated (with green granules) at the point of origin in the locule. Phialoconidia 3-5 × 1 (-1.5) µm, baciliform to oblong-elliptic with light green contents, occasionally hyaline. Stroma in section of strongly gelatinized hyphae forming a textura intricata, with green contents, becoming more parallel between pycnidial chambers, and brownish to black-walled at the surface of the stroma, 2-3.5 µm in diam.

Habitat: on decayed wood, staining the wood aeruginous. Occasionally found in association with its perfect states, *Chlorociboria aeruginascens* subsp. *aeruginascens* and *C. a.* subsp. *brasiliensis*.

Range and Seasons of Fructification: North and South America and Europe; collected in Summer and Autumn, apparently very rare.

Name: Latinized name of the Tulasne brothers.

Illustrations: Tulasne and Tulasne, Sel. Fung. Carp. 3: pl. 20, figs. 17-18. 1865 (ut *Sphaeria moriformis* var.); Bellemère, Bull. Soc. Mycol. France 83: 584, fig. 68 B, I, J. 1967 (ut *Chlorociboria aeruginosa*).

Exsiccati: Ellis and Everhart, North American Fungi No. 2047 (ut *Chlorosplenium aeruginosum,* Spermogonia) PAD-Saccardo (= CUP 51752), CUP-A; Fuckel, Fungi Rhenani No. 2479 (ut *Helotium aeruginosum,* fungus spermogonium) FH (= CUP 52697); Herbier Barbey-Boissier No. 1240 (ut *Chlorosplenium aeruginosum,* Fungus conidiophorus) BPI (= CUP 51855).

Specimens Examined: U.S.A. - CONNECTICUT: on alder, West Haven, R. Thaxter No. 194 (ut *Chlorosplenium aeruginosum,* conidial stage) FH (= CUP 52701).

AUSTRIA: Auf Holz, Sonntagsberg, Strasse s.n., Dec. 1910, FH-Höhnel No. 3329.

VENEZUELA: on green stained wood, cloud forest below (E. of) Hotel Humboldt, El Airla, Dto. Federal, Venezuela, R.W.G. Dennis No. 1195, 5.7.58 (ut *Chlorociboria* and imperfect stage) K.

EXCLUDED SPECIES AND SYNONYMS

1. CHLOROCIBORIA AERUGINELLA (Karst.) Dennis ex Ram., Korf & Bat. ≡ *Dasyscyphus aeruginellus* (Karst.) Korf & Dixon in Dixon; for complete synonymy see MYCOTAXON 1(2): 85. 1974.

2. [CHLOROCIBORIA AERUGINOSA var. AERUGINASCENS (Nyl.) Bellemère] ≡ *Chlorociboria aeruginascens* subsp. *aeruginascens,* q.v.

3. CHLOROCIBORIA BULGARIOIDES (Rabenh.) Ram., Korf & Bat. ≡ *Rutstroemia bulgarioides* (Rabenh.) Karst.; for complete synonymy see MYCOTAXON 1(2): 88-90. 1974.

4. CHLOROCIBORIA MUSAE Dennis, Kew Bull. 13: 460. 1958.

Notes: Examination of the type specimen of this species shows it to have an ectal excipulum of thin-walled, nearly hyaline, globose cells and ascospores 5-6 × 1.5-2 µm as reported by Dennis (1958). I feel this species is surely a member of the genus *Ciboriopsis.* Since many species of *Ciboriopsis* seem to grade into *Ciboria,* I hesitate to make a new combination until monographic work has been done on the genus *Ciboriopsis.*

Specimens Examined: BOLIVIA: on banana, Rio Yariza, Prov. Nor-Yungas, Dpto. La Paz, R. Singer No. B-1377, 23. 2. 1956, K (= CUP 51754), holotype specimen.

5. CHLOROCIBORIA RUGIPES (Peck) Ram. & Korf in Ram., Korf & Bat. = *Chlorencoelia torta* (Schw.) Dixon, q.v.

6. CHLOROCIBORIA STROBILINA (Alb. & Schw. per Fr.) Seaver = *Rutstroemia bulgarioides* (Rabenh.) Karst.; for complete synonymy see MYCOTAXON 1(2): 88-90. 1974.

7. CHLOROCIBORIA VERSIFORMIS (Pers. per Pers. : Fr.) Seaver ex Ram., Korf & Bat. ≡ *Chlorencoelia versiformis* (Pers. per Pers. : Fr.) Dixon, q.v.

8. CHLOROCIBORIA VERSIFORMIS var. OLIVACEA (Rodway) Dennis = *Chlorencoelia torta* (Schw.) Dixon, q.v.

THE GENUS CHLORENCOELIA DIXON

For two species that have been treated both in *Chlorosplenium* and in *Chlorociboria,* I now propose a new genus. Seaver (1951) apparently was the first person to recognize the affinities of these species when he transferred *Peziza versiformis* to the genus *Midotis*. (His concept of *P. versiformis* included both species of the genus.) During the course of this study I have observed several specimens of *Chlorencoelia torta* in which the cells of the ectal excipulum (of brown-walled textura angularis to textura globulosa) are loose and encoelioid. *Chlorencoelia* should be considered as a member of the Leotiaceae (= Helotiaceae), subfamily Encoelioideae. The members of *Cordierites* show similarities with *Chlorencoelia* both in gross morphological characters and more especially in their microanatomical features. It should also be noted that the species of *Chlorencoelia* show affinities with *Encoelia* (Fr.) Karst. and to some lesser extent with *Velutarina* Korf.

GENERIC DIAGNOSIS OF THE GENUS CHLORENCOELIA DIXON (HELOTIALES, LEOTIACEAE)

CHLORENCOELIA Dixon, *gen. nov.*

NAME: from Greek, "Chloris," the green one, + the generic name *Encoelia;* referring to the color of the apothecia plus the generic name of a related genus.

HOLOTYPE: Peziza versiformis Pers. per Pers., Myc. Eur. 1: 243. 1822, : Fr., Syst. Mycol. 2(1): 130. 1822.

Apothecia superficialia, solitaria vel gregaria vel in fasciculo caespitoso, stipitato conferta. Discus non profunde cupulatus vel infundibuliformis, convexoexpansus vel repandus in speciminibus magis maturis. Asci octospori, cylindraceo-clavati, basaliter longe angustati, ad apicem inoperculati, poro valde jodi ope azurescente, apicibus rotundatis vel subconicus. Ascosporae hyalinae, 0-1-septatae. Paraphyses septatae, filiformes, ad apices aliquando subclavatae, non ramificantes vel ramificantes prope basem. Subhymenium ex textura intricata hyaline et/vel dilute ferruginea formatum. Excipulum medullare ex textura intricata parietibus hyalina vel rufa, laxa vel stricta formatum, hyphis laevibus et/vel granulis rufis asperatis, sympodialiter ramosis. Excipulum ectale formatum ex textura angulari vel textura globulosa tenui vel crassa, hyalina vel parietibus rufa, et hyphas tomenti filamentosas vel subglobosas vel clare clavatus fere sub angulo 90° ab superficie apotheciorum abeuntes edente. Habitat in ligno carioso.

Apothecia: superficial, solitary to gregarious, occasionally in caespitose clusters from a common stipe.

Disc: shallow cupulate to infundibuliform, becoming convex-expanded to repand in mature specimens.

Asci: 8-spored, cylindric-clavate with long tapering stalks, apex inoperculate, strongly J+, apex rounded to subconic.

Ascospores: ellipsoid to cylindric-oblong to allantoid, unicellular to 1-septate, hyaline.

Paraphyses: filiform, septate, occasionally subclavate at the apex, unbranched or branching near the base.

Subhymenium: of hyaline and/or light brown textura intricata.

Medullary Excipulum: of hyaline to dark brown-walled, loose to tightly compacted textura intricata, hyphae smooth and/or roughened with dark brown granulations, sympodially branched.

Ectal Excipulum: of thin to thick walled, hyaline to dark-walled textura angularis to textura globulosa which give rise to filamentous or subglobose to definitely clavate tomentum hyphae oriented nearly perpendicularly to the flanks of the apothecia, tomentum hyphae frequently containing green pigmentation and/or green granules.

Habitat: on decorticated and decayed wood.

Notes: This genus is distinguished from *Cordierites* Mont., its closest relative, by its ascus apices which stain strongly blue in iodine, its apothecia being yellow-orange to olivaceous-green in color, its lack of an ionomidotic reaction in KOH, and its apothecia which do not branch and become irregularly lobed or lacerated as in *Cordierites*.

KEY TO THE SPECIES OF CHLORENCOELIA

1. Ascospores cylindrical to allantoid, (10-) 11-15 (-16) × 2.5-3.5 µm; medullary excipulum of hyaline to light brown-walled hyphae; ectal excipulum producing filamentous to slightly clavate tomentum hyphae........ .... 1. *C. versiformis*

1'. Ascospores irregularly ellipsoid, (5.6-) 9-11 (-12) × 2-4 µm; medullary excipulum of dark-walled hyphae; ectal excipulum of stalked, subglobose to definitely clavate tomentum hyphae.................... 2. *C. torta*

1. Chloroencoelia versiformis (Pers. per Pers. : Fr.) Dixon, *comb. nov.*

≡[*Peziza versiformis* Pers., Ic. Descr. Fung. p. 25, 1800.] (!!)

≡ *Peziza versiformis* Pers. per Pers., Myc. Eur. 1: 243. 1822, : Fr., Syst. Mycol. 2(1): 130. 1822.

≡ *Helotium versiforme* (Pers. per Pers. : Fr.) Fr., Summa Veg. Scand. p. 356. 1849.

≡ *Chlorosplenium versiforme* (Pers. per Pers. : Fr.) de Not., Comment. Soc. Critt. Ital. 1: 376. 1864.

≡ *Coryne versiformis* (Pers. per Pers. : Fr.) Schroet., Krypt.-Fl. Schles. 3^2(Lief. 1): 99. 1893.

≡[*Chlorociboria versiformis* (Pers. per Pers. : Fr.) Seaver, Mycologia 28: 393. 1936 (genus not validly published).]

≡ *Midotis versiformis* (Pers. per Pers. : Fr.) Seaver, N. Amer. Cup Fungi (Inopercul.), p. 94. 1951.

≡ *Chlorociboria versiformis* (Pers. per Pers. : Fr.) Seaver ex Ram., Korf & Bat., Mycologia 49: 860. 1958.

= *Craterellus caespitosus* Peck, Annual Rep. New York State Mus. 25: 82. 1873. (!!)

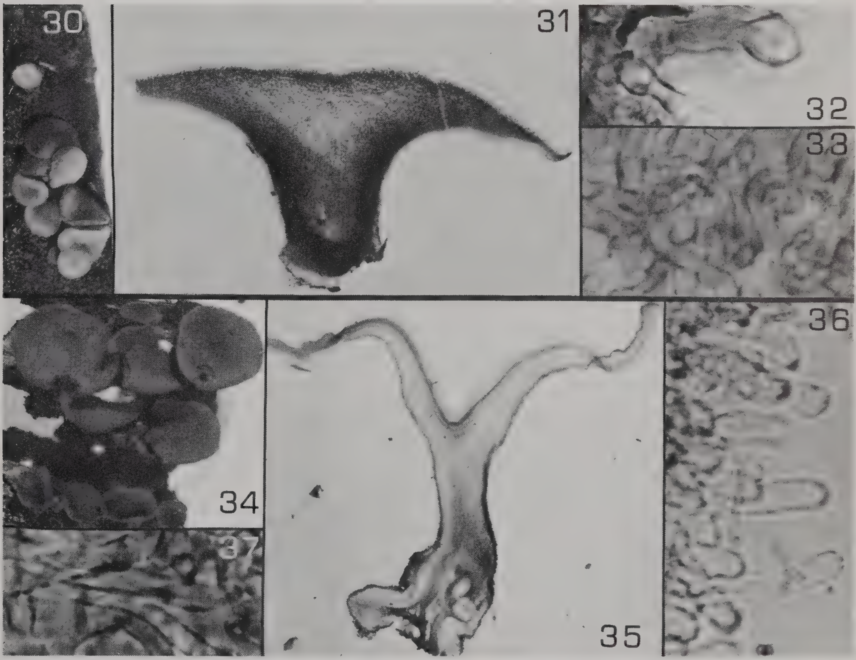
=[*Coryne sarcoides* (Gray) Tul. (ut "(Jacq.) Tul.") var. *viridescens* Rehm in Voss, Verh. Zool.-bot. Ges., Wien 37: 224. 1887 (*nomen nudum*).]

≡ *Coryne sarcoides* (Gray) Tul. [ut "(Jacq.)"] var. *viridescens* Rehm in Rabenhorst's Krypt.Fl. II 1^3(Lief. 35): 492. 1891. (!!)

(Figs. 34-37, 39)

Apothecia: superficial, solitary to gregarious, occasionally in caespitose clusters from a common stipe.

Disc: shallow cupulate to infundibuliform, becoming convex-expanded to repand in mature specimens, occasionally revolute, olive-yellow to olive-green in fresh specimens (Mars



FIGS. 30-36. Photographs of *Chlorencoelia* spp. FIGS. 30-33. *C. torta*. 30. Freshly collected apothecia, CUP 51796, approx. × 3.5. 31. Complete section of an apothecium, CUP 51730, approx. × 14. 32. A single tomentum hypha, CUP 51771, × 1400. 33. Medullary hyphae, CUP 51671, × 1600. FIGS. 34-37. *C. versiformis*. 34. Freshly collected apothecia, CUP 51710, approx. × 1.5. 35. Complete section of an apothecium, CUP 52734, approx. × 8. 36. Tomentum hyphae, CUP-D 4523 (77-47), × 2100. 37. Medullary hyphae, CUP 51710, × 1900.

Yellow to Olive Citrine) becoming chestnut brown to black (Mummy Brown to Black) upon drying, < 9 (-17) mm in diam, mostly 7-9 mm in diam.

Receptacle: dark olive-green to brownish-olive when fresh, drying to dark brown or greenish-black, with a pruinose greenish-yellow cast when dry, furrowed to rugose.

Stipe: < 7 × 0.5-1 mm, concolorous with the receptacle, glabrous, rugose especially upon drying.

Hymenium: (80-) 95-130 (-145) μm high, hyaline with occasional brown portions due to abundance of pigmented paraphyses.

Asci: cylindric-clavate with long tapering stalks, (79-) 95-130 (-150) × (4-) 5-8 μm (mean of collections 106 × 6 μm), 8-spored, strongly J+, apex rounded to subconic, wall at apex 1.5-3 μm thick, 0.5-1.0 μm thick along the sides, arising from repeating croziers.

Ascospores: irregularly biseriate, unicellular to submedian 1-septate, hyaline, smooth-walled, cylindric-oblong to allantoid, non-guttulate to bi-, tri-, tetra-guttulate, occasionally also including several smaller guttules, (10-) 11-15 (-16) × 2.5-3.5 μm (mean of collections 12 × 3 μm).

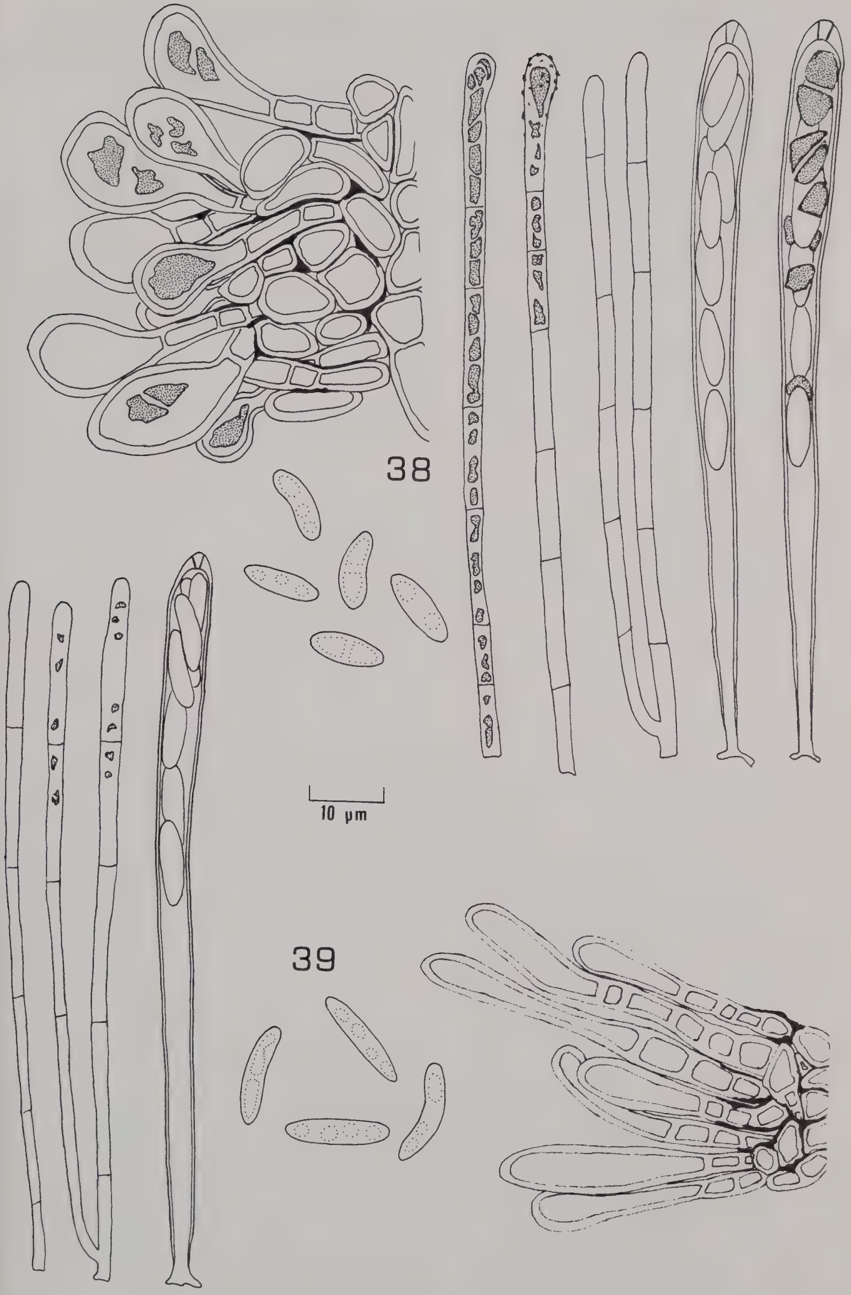
Paraphyses: filiform, occasionally subclavate at the apex, unbranched or branching near the base with the point of branching being so low in some specimens as to appear unbranched, hyaline or filled with numerous guttules and/or green granules, 2-3 μm in diam, scarcely longer than the asci.

Subhymenium: 20-35 μm thick, of hyaline and/or light brown-walled textura intricata, with hyaline or brown contents, hyphae 2.4-4.0 μm in diam.

Medullary Excipulum: of hyaline to light-brown, loose to tightly compacted textura intricata, portions often with collapsed hyphae; hyphae smooth or more often roughened with dark brown granulations, sympodially branched, 3-5 μm in diam.

Ectal Excipulum: 25-100 μm thick, of hyaline to dark-walled (especially in fully mature specimens) textura intricata to textura angularis which gives rise to filamentous to slightly clavate tomentum hyphae oriented nearly perpendicularly to the flanks of the apothecium; hyphae at the base of

FIGS. 38-39. Camera lucida drawings of *Chlorencoelia* spp. Pigments in amorphous or granular form shown shaded, × 1000. FIG. 38. *C. torta*. Portion of ectal excipulum and tomentum hyphae, three paraphyses, two asci and five ascospores, CUP 51671. FIG. 39. *C. versiformis*. Two paraphyses, four ascospores, and portion of ectal excipulum and tomentum hyphae, CUP 51708.


38
10 µm
39

the tomentum hyphae often highly septate, forming cuboid cells of various sizes, tomentum hyphae 5-7 µm in diam with hyaline walls 0.25 (-1.5) µm thick, in occasional specimens tomentum hyphae containing green pigment and/or granules. In KOH (2% aqueous), Aerosol, and Acid-alcohol producing a yellowish-green coloration in the mounting solution.

Cultural Characters: Very slow growing on agar (PDA), producing greyish-brown, humped-up colonies. No conidia produced. Agar appearing brownish-black when viewed from the underside. Hyphae 1.5-5 µm in diam, frequently branched, highly guttulate, thin-walled with occasional hyphae with dark brown granulations, contents hyaline to light-brown. Culture on deposit with American Type Culture Collection as ATCC 24031 (= specimen CUP 51710).

Habitat: decayed wood of angiosperm and gymnosperm trees; collected on *Betula, Nothofagus, Quercus, Tsuga,* and unidentified wood.

Range and Seasons of Fructification: world-wide; Summer and Autumn, most frequently in Autumn.

Name: from Latin, "verso," to turn up, to turn hither and thither, + "formo," shape or form; referring to the fact that the shape of the apothecium may be spathuloid or otideoid and sometimes convoluted.

Type Locatity: unknown (? Hercynia [Harz region, mid-Germany]).

Presumed Type Specimen: L-Persoon 910, 256-1329 (substrate, collector and date unknown) (= CUP 51760).

Illustrations: Persoon, Ic. Descr. Fung. Tab. 7, fig. 7, 1800 (ut *Peziza*)!; Berkeley, Outl. Brit. Fungol. Pl. 2, fig. 6, 1860 (ut *Helotium,* habit); Lagarde, Ann. Mycol. 4: figs. 43-45, 1906 (ut *Chlorosplenium*)!; Boudier, Ic. Mycol. Pl. 486, 1908 (ut *Chlorosplenium*)!; Seaver, Mycologia 28: 392. 1936 (ut *Chlorociboria*); Kobayasi, J. Jap. Bot. 13: 469. 1937 (ut *Chlorociboria*); Kobayasi in Asahina, Nippon Inkwasyokubutu Dukan, p. 300, Pl. 141, figs. 1-2, 1939 (ut *Chlorociboria*); Seaver, N. Amer. Cup-Fungi (Inopercul.) Pl. 99, fig. 1, 1951 (ut *Midotis*); Dennis, Mycol. Pap. 62, p. 47, fig. 40, 1956 (ut *Chlorociboria*); Ramamurthi, Korf and Batra, Mycologia 49: 856, fig. 3, 1958 (ut *Chlorociboria*); Dennis, Brit. Cup Fung. Pl. 15, fig. G, 1960 (ut *Chlorociboria*); Dennis, Brit. Ascomycetes, Pl. 18, fig. G, 1968 (ut *Chlorosplenium*).

Exsiccati: Berkeley, British Fungi Exs. No. 274 (ut *Peziza*) FH (= CUP 52700); Ellis and Everhart, North American Fungi No. 988 (ut *Chlorosplenium*) [a mixed collection, packets in some herbaria are *Chlorencoelia torta*!] CUP-D 11213 (77-61); Weese, Eumycetes Selecti Exs. No. 252 (ut *Chlorosplenium*) BPI (= CUP 51763).

Excluded Exsiccati: Herbier Barbey-Boissier No. 1285, issued as *Coryne versiformis* is *Rutstroemia bulgarioides;* de Thümen, Mycotheca Universalis No. 217 issued as *Helotium versiforme* is *Rutstroemia bulgarioides.*

Specimens Examined: U.S.A. - MICHIGAN: CUP 51708, 51709, 51777, 51778, 51797; CUP-D 10839 (77-115). MINNESOTA: CUP-D 10674 (77-114). NEW HAMPSHIRE: CUP-D 4529 (77-93). NEW YORK: CUP 51710, 51732, 51786, 51787, 51792; CUP-D 4522 (77-46), 4523 (77-47), 5984 (92-176); R.P.K. 871; NYS-Peck s.n., on old decayed log, Portville, September [? 1872], holotype of *Craterellus caespitosus*, isotypes: CUP 51721, CUP-D 6038 (77-100). NORTH CAROLINA: CUP 51772. OHIO: CUP-D 2687 (77-83), 4825 (77-98), 10720 (77-116). PENNSYLVANIA: CUP-D 3993 (77-90); PH-Schweinitz Syn. No. 900, (no substrate, no date, no collector - ? Schweinitz), Bethlehem, ut *Peziza versiformis* Pers. [= CUP-D 3993 (77-90)]. WEST VIRGINIA: CUP-D 6473 (77-104).

ARGENTINA: BA 21401.

CANADA - BRITISH COLUMBIA: BPI-Weir 2658. ONTARIO: BPI-Cain 10096 (= TRTC 10096), 30845, 32871 (= TRTC 32871); CUP-D 4532 (77-96); R.P.K. 2417 (= TRTC 30743). QUEBEC: BPI-Stevenson s.n., Aug. 24-26, 1938.

DENMARK: CP-Rosenvinge s.n., 9-10-1888.

JAPAN - HOKKAIDO: CUP-JA 2636.

SWEDEN: CUP-D 29 (77-60).

UNION OF SOVIET SOCIALIST REPUBLICS - RUSSIA: TAA-Parmasto 17785, Raĭtviĭr 42566 (= R.P.K. 3380).

YUGOSLAVIA: S-Rehm, Voss s.n., (no date), auf Lindenholz, Lees in Krain, holotype of *Coryne sarcoides* var. *viridescens* (= CUP 52709).

LOCALITY UNKNOWN: UPS-Fries s.n., (collector, locality and date unknown), ut *Peziza versiformis* (= CUP 51737); L-Persoon Herb. 910, 256-1329 (= CUP 51760), presumed holotype of *P. versiformis.*

Notes: This species is distinguished from *C. torta* by its more filamentous tomentum hyphae, much lighter colored medullary hyphae, and larger cylindrical to allantoid ascospores. The ascocarp of this species is usually somewhat larger, 7-9 (-17) mm in diam, whereas *C. torta* is usually < 7 mm in diam. As in *C. torta* the tomentum hyphae and paraphyses are often highly pigmented and/or granulated, but normally not to the extent exhibited in that species.

2. **Chlorencoelia torta** (Schw.) Dixon, *comb. nov.*
    ≡ *Peziza torta* Schw., Trans. Amer. Philos. Soc. 4: 175. 1832. (!!)
    ≡ *Chlorosplenium subtortum* Fr., Summa Veg. Scand. p. 356 (in nota). 1849, a gratuitous renaming.
    ≡ *Peziza subtorta* (Fr.) de Not., Comment. Soc. Critt. Ital. 1: 376. 1864.
    ≡ *Chlorosplenium tortum* (Schw.) Sacc., Syll. Fung. 8: 320. 1889.
= *Helotium rugipes* Peck, Annual Rep. New York State Mus. 26: 82. 1874. (!!) (!)
    ≡ *Lanzia rugipes* (Peck) Sacc., Syll. Fung. 8: 480. 1889.
    ≡ *Chlorociboria rugipes* (Peck) Ram. & Korf in Ram., Korf & Bat., Mycologia 49: 859. 1958.
    ≡ *Chlorosplenium rugipes* (Peck) Korf, Bull. Natl. Sci. Mus. 4: 391. 1959.
= *Ciboria olivacea* Rodway, Pap. & Proc. Roy. Soc. Tasmania 1924: 105. 1925. (!!)
    ≡ *Chlorociboria versiformis* (Pers. per Pers. : Fr.) Seaver ex Ram., Korf & Bat. var. *olivacea* (Rodway) Dennis, Kew Bull. 13: 340. 1958.
    ≡ *Chlorosplenium rodwayi* Korf, Bull. Natl. Sci. Mus. 4: 391. 1959, non *C. olivaceum* Rick 1931 nec *C. olivaceum* Seaver 1951.

(Figs. 30-33, 38)

Apothecia: superficial, solitary to gregarious, occasionally in caespitose clusters from a common stipe.

Disc: shallow cupulate to infundibuliform, becoming convex-expanded to repand in mature specimens, olive-yellow to olive-green in fresh specimens (Mars Yellow to Olive Citrine) becoming olive to deep olive green upon drying, edges of disc enrolling upon drying, < 7 (-12) mm in diam, mostly 3-7 mm in diam.

Receptacle: dark olive-green to brownish olive when fresh, with a pruinose greenish-yellow cast when dry, furrowed to rugose.

Stipe: < 3 × 0.5-1.0 mm, concolorous with the receptacle, glabrous, rugose especially upon drying.

Hymenium: (85-) 95-120 (-140) µm high, hyaline with brown portions due to abundance of pigmented paraphyses.

Asci: cylindric-clavate with a long tapered stalk, (69-) 90-121 (-126) × 5-7 µm (mean of collections 101 × 6 µm), 8-spored, strongly J+, apex rounded to subconic, wall at apex 1.5-3 µm thick, 0.5-1.0 µm thick along the sides of the ascus, arising from repeating croziers.

Ascospores: irregularly biseriate, unicellular, hyaline, smooth-walled, irregularly ellipsoid with rounded ends, prominently biguttulate, occasionally with several smaller guttules, (5.6-) 9-11 (-12) × 2-4 μm (mean of collections 9.6 × 3.0 μm).

Paraphyses: filiform, occasionally subclavate at the apex, unbranched or branching near the base with the point of branching being so low in some specimens as to appear unbranched, hyaline or filled with numerous guttules and/or green pigmented granules, septate, 2-3 μm in diam, scarcely longer than the asci.

Subhymenium: 20-35 μm thick, of hyaline and/or light brown textura intricata, hyphae 2-4 (-5) μm in diam.

Medullary Excipulum: of hyaline to dark brown-walled, loose to tightly compacted textura intricata, portions often with collapsed hyphae, in section darker than in *C. versiformis*, hyphae smooth and/or roughened with dark brown granulations, sympodially branched, 3-6 μm in diam with occasional hyphae ballooning out along their length to produce cells 13-20 × 25-30 μm in diam.

Ectal Excipulum: 35-115 μm thick, of thin to thick-walled, hyaline to dark-walled textura angularis to textura globulosa (often remaining as textura intricata, especially near the margins), giving rise to stalked, sub-globose to definitely clavate tomentum hyphae oriented nearly perpendicularly to the flanks of the apothecium, tomentum hyphae 8-12 μm in diam and frequently containing green pigments and/or green granules, occasionally with algal elements interspersed among the cells of the ectal excipulum.

Habitat: on decayed wood; collected on *Acer*, *Betula*, *Fagus*, *Quercus*, *Tabebuia*, coniferous and unidentified wood.

Range and Seasons of Fructification: North America, Puerto Rico, Japan, New Zealand, Tasmania, Union of Soviet Socialist Republics; Summer and Autumn.

Name: from Latin, "tortus," twisted, crooked; referring to the shape of the apothecia.

Type Locality: Salem [now Winston-Salem], North Carolina, U.S.A.

Presumed Type Specimen: (substrate unknown), Salem, Schweinitz, (no date), PH-Schweinitz Syn. Fung. No. 876-113 (= CUP 51670); isotypes: CUP-D 3365 (77-58), 3566 (77-59); UPS-Fries s.n. (= CUP 51734).

Illustrations: Dennis, Kew Bull. 13: 340, fig. 22, 1958 (ut *Chlorociboria versiforme* var. *olivacea*)!; Ramamurthi, Korf and Batra, Mycologia 49: 856, fig. 4, 1958 (ut *Chlorociboria rugipes*); Korf, Sci. Rep. Yokohama Natl. Univ. Sect. 2, Biol. Sci. 7: 27, figs. 13-14, 1958 (ut Tax. sp. VI et *Chlorociboria ? rugipes*)!.

Exsiccati: Ellis and Everhart, North American Fungi No. 988 (ut *Chlorosplenium versiforme*) [a mixed collection, packets in some herbaria are *Chlorencoelia versiformis*!] CUP-A.

Specimens Examined: U.S.A. - ALABAMA: CUP-D 3564 (77-88). CONNECTICUT: CUP-D 3563 (77-87). GEORGIA: CUP 37277; R.P.K. 813. INDIANA: CUP 52461. IOWA: CUP-D 8052 (77-105). KENTUCKY: CUP-D 10525 (77-113). MAINE: CUP 51731, CUP-D 5271 (77-99). MASSACHUSETTS: BPI-Cain 40545 (= TRTC 40545), 40560 (= TRTC 40560); CUP-D 4530 (77-94); R.P.K. 3826. MICHIGAN: CUP 51798. NEW JERSEY: CUP 51790; CUP-D 4533 (77-87), 5981 (92-173). NEW YORK: CUP 51671, 51711, 51712, 51730, 51789, 51791, 51793, 51794, 51796, 52627; CUP-LG 12; NYS-Peck s.n., on decayed wood, East Worcester, Otsego Co., July (no year), holotype of *Helotium rugipes*, isotypes: CUP-D 5982 (92-174), R.P.K. 2620; CUP-D 5983 (92-175), (no substrate), Adirondack Mts., Dr. Peck, (no date), authentic material of *Helotium rugipes*. NORTH CAROLINA: CUP 51769, 51771; CUP-D 9469 (77-106); PH-Schweinitz Syn. Fung. No. 876-133, (substrate unknown), Salem, (no date), presumed holotype of *Peziza torta* (= CUP 51670). OHIO: BPI-Elliott 12488 (= DAOM 12488); CUP 51788; CUP-D 4531 (77-95). PENNSYLVANIA: BPI-Henry 1385, 3035; CUP-D 564 (77-84), 3565 (77-89). VIRGINIA: CUP 51781, 51782, 51784. WISCONSIN: CUP-D 10022 (77-111); R.P.K. 2792.

CANADA - ONTARIO: BPI-Groves & Biggs 9251; R.P.K. 2415. QUEBEC: BPI-Shear 4167b.

JAPAN - HONSHU: CUP-JA 178, 479. KYUSHU: CUP-JA 414.

NEW ZEALAND: R.P.K. 3243 (= Dingley 19026).

PUERTO RICO: CUP-PR 4054.

TASMANIA: HO-Rodway s.n., (no substrate), National Park, (no collector), June 1924 (= CUP 52628, = R.P.K. 2842), holotype of *Ciboria olivacea*.

UNION OF SOVIET SOCIALIST REPUBLICS - RUSSIA: TAA-Kullman & Raĭtviĭr 61253, Parmasto 15418, 15469 (= R.P.K. 3375), 16220.

LOCALITY UNKNOWN: L-Persoon 910, 256-1318 (locality, date and collector unknown) ut *Peziza versiformis* (= CUP 51761).

Notes: This species while distinct from *Chlorencoelia versiformis* is often confused with it. The ranges of *C. torta* and *C. versiformis* overlap. The paraphyses and the subglobose to definitely clavate tomentum hyphae of *C. torta* often have strongly green pigmented and heavily granular contents. I have examined specimens which appear to be malformed in that they possess a poorly developed hymenium. When this occurs, such specimens always exhibit paraphyses and tomentum hyphae with an abundance of pigmentation.

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MYCOTAXON

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BOOK REVIEWS

by

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MYCOLOGIST'S HANDBOOK, AN INTRODUCTION TO THE PRINCIPLES OF TAXONOMY AND NOMENCLATURE IN THE FUNGI AND LICHENS, par D.L. HAWKSWORTH, 231 p., 22 figs., 16 x 24 cm, relié toile. Publ. C.M.I., Kew, distribué par Commonwealth Agricultural Bureaux, Farnham Royal, Slough SL2 3BN, U.K., 1974. £5.5o.

Ce livre peut être considéré comme une revision complète du livre de G.R. BISBY "An Introduction to the Taxonomy and Nomenclature of Fungi", dont la seconde édition fut épuisée en 1969.

Le but du livre est d'initier aux principes et aux méthodes de l'étude taxonomique des champignons et lichens. Il va de la récolte à la publication, en passant par toutes les étapes de l'étude systématique: l'examen des échantillons, leur préservation en herbier, la culture, la description, les mensurations, le dessin, les catégories taxonomiques, le travail en herbier, la recherche bibliographique, la dénomination, les synonimies, la citation des auteurs, les méthodes taxonomiques (taxonomie numérique, cartes perforées), le travail monographique, le relevé géographique et écologique, la référence aux ouvrages et périodiques, la préparation du manuscrit, la correction des épreuves et le tirage à part. A cela s'ajoutent des listes des principaux auteurs, herbiers et ouvrages mycologiques et un glossaire des termes de taxonomie et de nomenclature.

De plus, comme le fit BISBY, l'auteur reproduit dans leur quasi entièreté les règles de nomenclature des champignons selon le dernier Code International de Nomenclature Botanique (1972). Au texte des règles, l'auteur ajoute de nombreux exemples commentés tirés de la mycologie et de la lichénologie, tandis qu'il délaisse les exemples du Code relatifs aux autres groupes botaniques. En introduction aux règles, l'auteur initie clairement le lecteur aux concepts essentiels de validité de publication, d'application des noms fixée par typification, de légitimité des noms, de priorité du nom légitime correct et de conservation.

Par la somme d'informations pratiques et le commentaire des règles de nomenclature, ce livre est vraiment un "Manuel pour le Mycologue", encore faut-il comprendre

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CULTURAL CHARACTERS OF CERTAIN AMANITA TAXA.[1]

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Summary

Several freshly collected fruit bodies of *Amanita* taxa were isolated in pure culture. Following the procedure of Nobles (1965) the isolates were assigned key codes. Although basic similarities were observed, Nobles' key lacked the diagnostic characters to adequately describe or separate them. Because of the differential and rapid growth and distinctive taxonomic characters on potato dextrose agar, it was a more useful reference medium for *Amanita* than malt agar.

Names and numbers of isolates of taxa reported here follow: *Amanita citrina* (1); *A. citrina* f. *lavendula* (1); *A. flavoconia* (2); *Amanita* sp. affin *flavoconia* (1); *A. muscaria* (3); *A. polyparamis* (1); *A. rubescens* (1); *Amanita* sp. affin *strobiliformis* (1); *A. velatipes* (1).

Cultural taxonomy was shown to have validity in supplementing classical taxonomy in *Amanita*. Although morphological and anatomical fruit body characters sometimes showed only slight differences cultural characters were distinctive. Thus, a combination of cultural and classical taxonomy has potential for providing the most comprehensive descriptions and separation of

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[1] This paper has been extracted from a thesis submitted in partial fulfillment of the requirements for the degree Master of Science in Botany, University of Tennessee, by MPC. Contribution no. 437.

taxa.

Outstanding microscopic features, including hyphal forms, basidia, blastospores, and clamp connections are illustrated.

INTRODUCTION

As a valid generic name, *Amanita* dates from the publication of W. J. Hooker's "Flora Scotica" in 1821 (Donk, 1962), and the present macroscopic concept of the genus is consistent with Hooker's description: "Bursting from a volva. Pileus fleshy, generally warted. Gills crowded, nearly entire. Stipes mostly elongated, annulate, or naked." In addition, the gills are usually free and the spore print white or nearly white.

Classification of species of the genus has relied primarily on variations of these macroscopic characters. In more modern taxonomy, the distribution and hyphal construction of volval remnants on the mature fruit body have been used as diagnostic features. Bas (1969) proposed preliminary sections of *Amanita* based on volval characters in combination with amyloidity of spores and sulcation of the pileus margin. The microscopic structure of the volva is now being studied to help in determining relationships between large infrageneric groups and in assigning the growing number of species to smaller units within these alliances.

Davidson, Campbell, and Vaughn (1942) were the first to report extensively on culture characters of basidiomycetes. They used their data to establish a "key pattern" for the identification and classification of wood-rotting fungi, emphasizing mat color, oxidase reaction, growth rate, and microscopic hyphal structures. Nobles (1948) expanded the system of Davidson *et al.* into a key to be used for identification, included more species, and devised a standard method for cultural study of wood-rotting fungi so that additional species could be incorporated. Nobles (1958b) attempted to correlate cultural characters with the taxonomy and phylogeny of the Polyporaceae, and in her most comprehensive key (1965), enlarged the number of characters and established the standards used by most researchers for describing cultures of basidiomycetes.

No published reports have been found to formally describe cultural characters in agaric taxa. While many investigations have included manipulation of agaric cultures, the key code system of Nobles has not been applied, and formal descriptions of cultures are apparently completely lacking. Although valid reasons for such omissions are many, perhaps chiefly that cultures of agaric taxa have hitherto been unnecessary for purposes of identification, the application of a well-known cultural taxonomic system such as that by Nobles, appears worthwhile. At worst, it could prove useless for agaric cultures; at best, it could systematize valuable additional taxonomic information. It was against this background that the present preliminary study was attempted.

METHODS AND MATERIALS

Specimens were collected throughout summer, 1973 in the Knoxville vicinity and fall, 1973 in Nova Scotia, Canada. The gills of young sporocarps, especially buttons with intact veils, were used to establish dikaryon cultures in malt agar, employing the initial isolation technique described by Petersen (1972). The regimen outlined by Nobles (1965) was followed for the growth, incubation, and examination of the cultures. In addition to malt agar (Difco: "MA"), isolates were grown on malt agar supplemented with 0.005g/l each of biotin and thiamin ("MA+"), and on potato dextrose agar (Difco: "PDA"). The rationale was to provide a basis for comparison and further description.

Key character code numbers were taken from Nobles (1965). Colors enclosed in quotation marks were taken from Ridgway (1912). Fruit bodies were annotated, dried, and deposited in the herbarium of the University of Tennessee (TENN).

Isolate numbers, names, and voucher herbarium specimens are cited below.

Descriptions are based on observations from 3-5 replicate plates. In species with several isolates, their common characteristics are described apart from characteristics unique to an individual isolate, with reference to distinguishing features of the fruit bodies.

Terms used for describing mat texture are listed and defined by Nobles (1965), in addition to which the term "*helicoid*" refers to spiralling, tendril-like, usually aerial hyphae, varying in diameter from that of a normal undifferentiated generative hypha to much more slender. Long hyphal tips may be coiled or coiling may encompass only short intercalary or terminal segments. "Vesicular" describes hyphae which include intermittent enlarged, rounded, spherical, lobose, or utriform cells. "Gloeoplerous" is used to describe cells the contents of which are refringent and assumed oleiferous.

Extracellular oxidase reactions include the Bavendamn test, following the procedure described by Davidson, Campbell, and Blaisdell (1938) on tannic acid agar, and the guaiacum test outlined by Nobles (1958) on malt agar.

RESULTS

Amanita citrina (Schaeffer) Gilbert, Iconogr. Mycol.,
Milano, xxvii, Suppl. I, p. 78, 1941.

Isolate: Kejimkujik National Park, Victoria Lake,
Annapolis Co., Nova Scotia, Can., 11.
ix.73., TENN no. 38253

Key Code: MA, MA+,PDA: 1. 6. 26. 32. 36. 38. 47. 56.

Colony on MA approx 4 mm diam after 6 weeks, mat white to "tilleul buff", appressed wooly, spreading; margin uneven. Advancing zone: hyphae generative, less than 2 μ diam, filamentous becoming variable in diameter. Mat: hyphae generative, typically gnarled, moniliform, sometimes with refringent guttules, finger-like projections near some septa resembling aborted clamp connections or juvenile branches. (Fig. 1, C.) Extracellular oxidase reactions negative.

Colony on MA+ approx 4 mm diam in 6 weeks, mat white, profuse, cottony; margin even. Advancing zone: hyphae generative, thin-walled, without clamp connections, of 2 morphological types: a) approx 2 μ diam, filamentous, relatively untangled, unbranched hyphal tips, occasionally refringent; b) up to 4 μ diam, cells with swollen ends, commonly branched, with numerous lateral

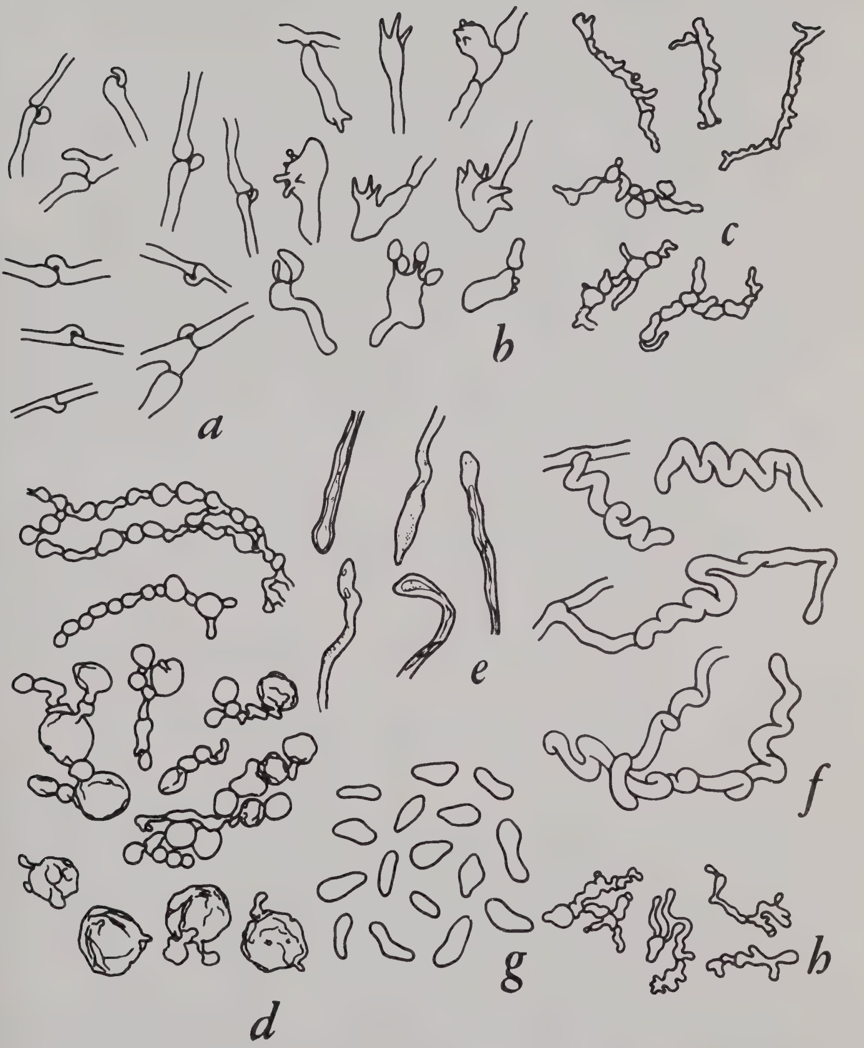

Fig. 1. Hyphae of Amanita cultures. a. Clamp connections. b. Basidia. c. gnarled, profusely branched hyphae. d. Monikiform hyphae. e. Refringent hyphae. f. Helicoid hyphae. g. Blastospores. h. Lobose cells. a. Amanita affin strobiliformis. b, e, g. A. citrina var. lavendula. c. A. citrina. d, h. A. muscaria. f. A. velatipes.

protrusions. Mat: hyphae generative, moniliform, including large, collapsed vesicles, empty or with granular contents, sometimes detached and possibly senescent.

Colony on PDA approx 6 mm diam after 6 weeks, white becoming "tilleul buff" toward margin, mat appressed wooly, diffusely spreading with scattered areas of concentrated growth; margin uneven. Advancing zone: hyphae generative, without clamp connections, cell apices inflated or septa with short, occasional, finger-like projections, of 4 morphological types: a) 1.5-2.0 μ diam, unbranched, filamentous, often in strands; b) approx 2-3 μ diam, gnarled by short, blunt, evenly spaced lateral protrusions and large, swollen, irregularly lobose cells; c) 3-5 μ diam, moniliform, especially prevalent in older mat; d) helicoid hyphae. Mat: hyphae generative, similar to advancing zone.

Amanita citrina f. *lavendula* Vesely, Atlas Champ. Eur.
Ser. A., 1: 20, 1934.

Isolate: Great Smoky Mountains National Park, Cades Cove, Tenn., 5.x.73., Tenn. no. 38290.

Key Code: MA, MA+: 1. 6. 7. 33. 36. 38. 46. 56.
PDA: 1. 6. 32. 36. 38. 47. 56.

Colony on MA exceeding 100 mm diam within 5-6 weeks, aerial mycelium "pale ochraceous buff", mat coarsely wooly except finely farinaceous around inoculum, scattered areas of denser growth; margin uneven. Advancing zone: hyphae generative, 2-5 μ diam, thin-walled, without clamp connections, with numerous blunt lateral protrusions initiating branches; helicoid hyphae sometimes intertwining, with heterogeneous contents. Mat: hyphae generative, 3-5 μ diam, without clamp connections, mostly filamentous, with frothy contents; basidia in oldest regions with 2-7 blunt sterigmata (Fig. 1, b); blastospores 2-3 X 3-9 μ, spherical, oval, fusiform, utriform to elliptical, all variably constricted, formed on lateral conidiophores as blown-out vesicles (Fig. 1, g). Extracellular oxidase reactions negative.

Colony on MA+ approx 92 mm diam in 6 weeks, color and texture similar to MA but uniformly dense; margin even.

Advancing zone: hyphae generative, of 2 morphological types: a) 1-4 μ diam, thin-walled, without clamp connections, frequently branched, undifferentiated except for some swollen, refringent hyphal tips with thickened walls; b) 2-4 μ diam, thin-walled, filamentous, without clamp connections, with refringent material intermittently lining walls or forming globules.

Colony on PDA approx 33 mm diam after 6 weeks, diminishing in color from "pale ochraceous buff" near inoculum to almost colorless on margin, mat wooly and diffuse except farinaceous and opaque near inoculum; margin even. Advancing zone: hyphae generative, approx 2 μ diam, frequently coiled, knotted, and sometimes twining into hyphal ropes. Young mat: hyphae generative, approx 1-4 μ diam, abundantly branched, contents heterogeneous and sometimes refringent; some elongated, nonseptate, refringent hyphal tips with thickened walls, ropy or granular contents, swollen ends sometimes membrane-bound, rarely with protrusions resembling sterigmata, possibly constituting an incipient hymenium (Fig. 1, e). Older mat: hyphae generative, approx 2-3 μ diam, filamentous, highly branched.

Amanita flavoconia Atkinson, Journ. Mycol. 8: 110, 1902.

Isolate: Black Hole, near Baxter's Harbor, Kings Co., Nova Scotia, Can., 30.viii.73, Tenn. no. 38036.

Key Code: MA, MA+, PDA: 1. 6. 26. 32. 36. 38. 47. 56.

Isolate: Gaspareau Woods, approx 3 mi SE Wolfville, Kings Co., Nova Scotia, Can., 28.viii.73, Tenn. no. 37906.

Key Code: MA, MA+: 1. 6. 26. 32. 36. 38. 47. 56.
PDA: 1. 6. 26. 32. 36. 38. 47. 53. 56.

Colony on MA 16-20 mm diam in 6 weeks; aerial mycelium "tilleul buff"; submerged mycelium "cinnamon buff"; mat felty, topography flat, older mat tough, resilient; advancing zone thin, homogeneous, untangled; margin uneven. Advancing zone: hyphae generative, approx 3 μ diam, thin-walled, without clamp connections, typically gnarled by alternate swelling and constriction, sometimes moniliform and appearing to bud, occasionally loosely coiled and intertwined, some areas with large, refringent guttules. Mat: hyphae generative, up to 5 µ diam, thin-walled, with swollen apices, without clamp connections, gnarled, vesicular; large, irregularly lobose and broadly clavate cells occurring in series as well as interspersed; a few regions of numerous helicoid hyphae, sometimes coiled only for a short distance and then becoming normal, otherwise coiled along entire length of hyphal tip; spherical terminal cells, 14-30 µ diam, frequent with contents homogeneous, frothy, vacuolate, or refringent, confluent with wall or shriveled and collapsed. Extracellular oxidase reactions negative.

38036. Advancing zone: a few short parallel hyphae aggregated into rope-like rhizomorphs.

37906. Mat: hyphae approx 5 µ diam, highly branched; terminal vesicles sometimes with slightly thickened walls.

Colony on MA+ approx 11-13 mm diam in 6 weeks, "tilleul buff" alternating with concentric white zones and corresponding to appressed vs. aerial topography, respectively, texture felty becoming finely farinaceous where mycelium submerges, advancing zone dense, almost opaque; margin uneven. Advancing zone: hyphae generative, thin-walled, without clamp connections, with swollen apices, moniliform or closely compacted with heterogeneous contents; gloeoplerous generative hyphae occasional, with refringent material lining walls or forming regular guttules, with terminal and intercalary vesicles, 16-20 µ diam often with refringent inclusions. Mat: hyphae generative, nearly always gloeoplerous, moniliform, and intricately branched.

Colony on PDA 19-21 mm diam in 6 weeks, "cream buff"; mat mostly submerged; surface coarsely granular to subfelty; advancing zone translucent, tangled, spreading diffusely; margin uneven. Advancing zone: hyphae generative, 3-5 µ diam along length, thin-walled, without clamp connections; contents heterogeneous including vacuoles, refringent guttules and refringent material intermittently lining walls; cells often inflated asymmetrically at base, sometimes clavate; terminal and intercalary vesicles with heterogeneous contents; moniliform and helicoid hyphae scattered. Mat: hyphae as above but increasingly moniliform, in number and degree.

38036. Colony: distinctly zonate, zones concentric with wavy, cottony margins, texture downy, appressed.

37906. Colony: odor acidic.

Amanita sp. (affin *flavoconia*)

Isolate: Scot's Bay, Cape Split, Kings Co., Nova
Scotia, Can., 29.viii.73, Tenn. no.
37929.

Key Code: MA, MA+, PDA: 1. 6. 26. 32. 36. 38. 47. 56.

Colony on MA approx 40 mm diam in 6 weeks, aerial mycelium "tilleul buff", submerged mycelium "cinnamon buff", felty, advancing zone thin, homogeneous, untangled; margin uneven. Advancing zone: hyphae generative, 2-3 µ diam, thin-walled, without clamp connections or inflated ends; contents frothy to granular; numerous lateral protrusions initiating branches; some swollen, broadly clavate cells in series but no moniliform chains; gloeoplerous hyphae with small guttules; helicoid hyphae of normal diameter. Extracellular oxidase reactions negative.

Colony on MA+ approx 17 mm diam in 6 weeks, aerial mycelium "pale vinaceous fawn", submerged mycelium "cream buff", wooly, submerging in advancing zone; margin uneven. Advancing zone: hyphae generative, as above, mostly undifferentiated.

Colony on PDA approx 40 mm diam in 6 weeks, "olive buff", uniformly dense, wooly, mostly submerged; margin uneven. Advancing zone: hyphae generative, 3-5 µ diam, thin-walled, without clamp connections, nuclei conspicuous; swollen intercalary cells preceding branching; clavate cells typical, segregated on long hyphal tips; some gloeoplerous hyphae with small refringent guttules; terminal and intercalary vesicles with deeply staining contents; moniliform hyphae not common. Mat: hyphae generative, similar to advancing zone.

Amanita muscaria (L. per Fr.) Hook., Flora Scotica, London,
p. 19, 1821.

Isolate: Gaspareau Woods, approx 3 mi SE Wolfville, Kings Co., Nova Scotia, Can., 28.viii.73, Tenn. no. 37908.

Key Code: MA, MA+, PDA: 1. 6. 10, 26. 32. 36. 38. 47. 56.

Isolate: Scot's Bay, Cape Split, Kings Co., Nova Scotia, Can., 29.viii.73, Tenn. no. 37928.

Key Code: MA, MA+: 1. 6. 26. 32. 36. 38. 47. 56.
PDA: 1. 6. 26. 32. 36. 38. 47. 51. 56.

Isolate: Kejimkujik National Park, Victoria Lake, Annapolis Co., Nova Scotia, Can., 11.ix.73, Tenn. no. 38250.

Key Code: MA, MA+, PDA: 1. 6. 26. 32. 36. 38. 47. 56.

Colony on MA:

37908. Colony approx 5 mm diam after 6 weeks, aerial mycelium white, submerged mycelium "drab gray", mat felty to velvety, highly convoluted; margin even.

37928. Colony approx 23 mm diam in 6 weeks, "light pinkish cinamon" surrounding inoculum, sharply demarcated from "pale pinkish buff" mycelium toward margin, homogeneously wooly with occasional hyphal tufts, not submerging; margin even.

38250. Colony approx 6 mm diam in 6 weeks, "avellaneous"; mat mostly aerial, texture chamoislike, extremely convoluted; margin uneven.

Advancing zone: hyphae generative, without clamp connections, contents heterogeneous, of 4 morphological types: a) very common vesicular to moniliform or articulated, with bizarre lobose or spherical cells (Fig. 1, h), interconnected in one isolate only (37908), frequently branched, often with large rough-walled vesicles approx 20 µ diam, empty and collapsed or with refringent contents, sometimes detached (Fig. 1, d); b) approx 2 µ diam, filamentous; c) approx 3 µ diam, thin-walled, composed of elongated cells with swollen apices; d) 4 µ diam or greater, long, occasionally refringent, cells with swollen apices. Mat: hyphae generative, similar to advancing zone with more extreme cell shapes and increased refringence. Extracellular oxidase reactions negative with gum guaiacum, no growth but a faint brown diffusion zone on tannic acid agar (37908 and 38250), no diffusion zone (37928).

Colony on MA+:

37908. Colony approx 5 mm diam in 6 weeks, mat similar to MA.

37928. Colony approx 30 mm diam in 6 weeks, mat similar to MA except becoming submerged toward margin.

38250. Colony approx 6 mm in 6 weeks, "wood brown", mat felty and farinaceous due to intermingling of white hyphae, compact, tightly convoluted, growing upward on itself rather than into agar; margin uneven.

Advancing zone: hyphae generative, approx 3 µ diam, thin-walled, without clamp connections, of 3 morphological types: a) predominantly moniliform or vesicular with large lobose, randomly constricted and inflated cells, vesicles sometimes actively budding new vesicles or branches, empty and collapsed or contents refringent or homogeneous; b) approx 3 µ diam, filamentous, moderately branched, contents granular; c) (37928 only) approx 2 µ diam, short, tendril-like helicoid hyphae, tightly coiled in older mat. Mat: hyphae generative, similar to advancing zone.

Colony on PDA:

37908. Colony approx 2 mm diam in 6 weeks, mostly restricted to inoculum block, aerial mycelium white, submerged mycelium "drab gray", mat downy, convoluted, compact, advancing zone irregularly spreading; margin uneven.

37928. Colony approx 19 mm diam in 6 weeks, "cartridge buff", mat wooly, with massed aerial hyphae of variable density; margin uneven with areas of diffuse, silky, submerged hyphal tips. Odor of urine, faintly earthy.

38250 Colony approx 8 mm after 6 weeks, "buckthorn brown", mat chamoislike with white felty concentric zones, undulating topography of mat corresponding to crenations in advancing margin; margin uneven.

Advancing zone: hyphae generative, thin-walled, without clamp connections, contents moderately vacuolate, cells often with swollen apices, hyphae of 4 morphological types: a) vesicular and moniliform, with large (12-22 µ diam) terminal vesicles and intercalary utriform cells, both turgid and collapsed, sometimes refringent, interconnected in one isolate only (37908); b) approx 2 µ diam, filamentous, often copiously branched, cells with swollen apices; c) 3-5 µ diam, composed of bulbous cells; d) (37928 only) helicoid hyphae, approx 3 µ diam and loosely coiled or 1-2 µ diam and tendril-like. Mat: hyphae generative, including types in advancing zone but predominantly moniliform and refringent with large terminal vesicles.

Amanita polypyramis (Berk. and Curt.) Sacc., Syll. Fung. 5: p. 18, 1887.

Isolate: Gatlinburg, Tenn., Sevier Co., 16th hole, Gatlinburg Country Club, 16.x.73., Jenkins coll., DJ723 (herb. D. J. Jenkins).

Key Code: MA, MA+: 1. 6. 26. 32. 36. 38. 47. 53. 56.
PDA: 1. 6. 26. 32. 36. 38. 47. 56.

Colony on MA approx 78 mm diam in 6 weeks, chalk white, mat raised, cottony becoming flattened and downy toward margin, prominently zonate; margin even. Advancing zone: hyphae generative; a) approx 2 µ diam, thin-walled, without clamp connections, branched; b) approx 4 µ diam, filamentous with refringent guttules. Mat: hyphae generative, similar to advancing zone. Extracellular oxidase reactions negative.

Colony on MA+ approx 6 mm diam in 6 weeks, chalk white, mat cottony becoming thin and appressed in advancing zone; margin even. Odor of rancid pork. Advancing zone: hyphae generative, thin-walled, without clamp connections, of 3 morphological types: a) 3-4 µ diam, frequently branched, highly vacuolated especially in terminal vesicles which are often gloeoplerous; detached vesicles appearing rough walled, collapsed, with inner membrane shrunken and separating from wall; b) helicoid, appearing knotted due to extreme coiling; c) moniliform, consisting of spherical and randomly lobose cells. Mat: hyphae generative, similar to advancing zone.

Colony on PDA approx 64 mm diam in 6 weeks, chalk white, cottony becoming downy away from inoculum with interspersed raised areas; margin uneven. Advancing zone: hyphae generative, approx 3 μ diam, without clamp connections, frequently with slightly thickened cells, uniformly filamentous or interspersed with spherical and clavate cells with extremely heterogeneous contents, sometimes with small gloeoplerous guttules; terminal vesicles 12-18 μ diam, with walls sometimes roughened and thickened and contents shrunken from wall, often with smaller vesicles or hyphal initials protruding laterally. Mat: hyphae generative, mostly moniliform with refringent globules concentrated in cell apices, otherwise contents homogeneous, budding of new vesicles and lateral branching common.

Amanita rubescens (Pers. per Fr.) S. F. Gray, Nat. Arr.
Brit. Plants, 1: 600, 1821.

Isolate: Kings Co., Nova Scotia, Can., 10.ix.73.,
Tenn. no. 38249.

Key Code: MA, MA+, PDA: 1. 6. 26. 32. 36. 38. 47. 56.

Colony on MA approx 50 mm diam in 6 weeks, "tilleul buff", mat wooly, submerged toward advancing zone; margin even. Advancing zone: hyphae generative, 3-4 μ diam, thin-walled, without clamp connections, undifferentiated except for some short, irregularly thickened, swollen cells, large vacuoles, and refringent guttules. Mat: hyphae generative, 3-4 μ diam, thin-walled, without clamp connections; bulbous cells and terminal vesicles occasional, often with granular contents; helicoid hyphae with variable coiling, loosely folded or accordianed to tightly spiraled. Extracellular oxidase reactions negative with gum guaiacum, no growth but a faint brown diffusion zone on tannic acid agar.

Colony on MA+ approx 44 mm diam after 6 weeks, "pale olive buff", aerial and wooly near inoculum, submerged in advancing zone; margin even. Advancing zone: hyphae generative, 3-4 μ diam, thin-walled, without clamp connections, filamentous, unbranched and undifferentiated tips or occasionally shorter with irregularly thickened walls and dense contents; helicoid hyphae present. Mat: hyphae generative, similar to advancing zone but with thickened, fusiform cells, singly and in chains.

Colony on PDA approx 40 mm diam after 6 weeks, off-white, wooly overall, ranging from loose tangles to dense tufts; margin even. Advancing zone: hyphae generative, of 4 morphological types; a) approx 4 µ diam, thin-walled, without clamp connections, cell apices often swollen preliminary to branching; b) moniliform, with thickened cells and large, terminal, densely staining vesicles; contents becoming heterogeneous with age and size; c) helicoid, varying from tightly coiled to slightly serpentine or folded; d) approx 2 µ diam, with refringent guttules. Mat: hyphae generative, as in advancing zone with increasing heterogeneity in form and contents.

Amanita sp. (sect. *Lepidella* affin. *strobiliformis*)

Isolate: Gatlinburg, Tenn., Sevier Co., 16th hole, Gatlinburg Country Club, 16.x.73., Jenkins coll., DJ725 (herb. D. J. Jenkins).

Key Code: MA, MA+: 1. 6. 26. 32. 36. 39. 47. 56.
PDA: 1. 5. 7. 32. 36. 39. 47. 50. 56.

Colony on MA restricted to inoculum block after 6 weeks, mycelium white, sparse, cottony, agar reverse "fuscous" under inoculum. Hyphae generative, thin-walled, without clamp connections, short, vesicular; numerous vesicles detached from hyphae, 16-28 µ diam, mostly spherical, sometimes collapsed, empty or with homogeneous, frothy, granular, or gloeoplerous contents. Extracellular oxidase reactions negative.

Colony on MA+ barely exceeding inoculum after 6 weeks, rudimentary mat "avellaneous", totally submerged; margin even. Advancing zone: hyphae generative, without clamp connections, of 4 morphological types: a) 2-5 µ diam, thin-walled, unbranched, hardly tangled hyphal tips, frequently severely constricted and nonstaining for short distances, then resuming normal diameter; b) moniliform, with vesicles appearing to bud out one or more smaller vesicles; numerous large, collapsed, nonstaining vesicles, terminal, intercalary, or detached; c) thin, tightly coiled, tendril-like helicoid hyphae; d) undifferentiated or vesicular hyphae with refringent guttules.

Colony on PDA approx 22 mm diam after 6 weeks, aerial mycelium white, cottony, submerged mycelium "tilleul buff" with "chestnut brown" band immediately surrounding inoculum; margin even. Odor strong, slightly spicy, fungal, reminiscent of dried apples. Advancing zone: hyphae generative, 3-5 (8) µ diam, thin-walled, with rare clamp connections and false clamps (Fig. 1, a), contents homogeneous to slightly vacuolate, morphologically undifferentiated. Mat: generative hyphae similar to advancing zone, dolipore apparatus especially prominent seen at 2000X magnification.

Amanita velatipes Atkinson, 1903. Mushrooms, pp. 63-66, Figs. 64-67.

Isolate: Unaka Mts., Unicoi Co., Tenn., 12.viii.73., Jenkins coll., DJ674 (herb. D. J. Jenkins).

Key Code: MA, MA+: 1. 6. 16. 32. 36. 38. 47. 53. 56.
PDA: 1. 6. 7. 32. 36. 39. 47. 56.

Colony on MA approx 8 mm diam after 6 weeks, aerial mycelium chalk white, submerged mycelium "pale olive buff", mat velvety with scattered cottony tufts, not spreading but very compressed and highly convoluted; margin even. Advancing zone: hyphae generative, approx 3 µ diam, thin-walled, without clamp connections, long, unbranched, hardly tangled or vacuolated, commonly with small refringent guttules. Mat: hyphae generative, as in advancing zone with areas of abundant gloeoplerous generative, often inflated hyphae. Extracellular oxidase reactions negative.

Colony on MA+ approx 19 mm diam in 6 weeks, velvety and highly contoured close to inoculum, becoming appressed in a narrow concentric zone, finally forming a raised cottony, chalk white aerial mycelium of variable density; macroscopic hyphal "ropes" traversing appressed zone; margin uneven. Odor faint, of ammonia. Advancing zone: hyphae generative, thin-walled, 2-4 µ diam, without clamp connections, long, hardly tangled, contents homogeneous except for vacuoles, branching commonly at acute angles. Mat: hyphae generative, with numerous intercalary vesicles, sometimes with refringent inclusions; helicoid hyphae common, with coiling encompassing entire length of hyphal tip or merely short intercalary or terminal segments (Fig. 1, f). Hyphal ropes consisting of parallel hyphae up to 650 μ long, highly vacuolate, unbranched, sometimes with refringent guttules.

Colony on PDA approx 35 mm diam in 6 weeks, felty near inoculum, with adjacent narrow, dark ("pale olive buff") appressed zone sharply delimited from conspicuously raised, chalk white cottony mat, progressively submerging toward margin; margin even. Advancing zone: hyphae generative, thin-walled, 3-5 μ diam, with clamp connections, mostly filamentous, with branching from lateral protrusions. Mat: hyphae generative, similar to advancing zone but usually gloeoplerous.

DISCUSSION

While there are several distinctive morphological hyphal types and cell shapes in cultures of *Amanita*, taxa cannot be successfully segregated using Nobles' key code for the Polyporaceae. Dichotomies designed for recognizing and differentiating taxa on the basis of special structures are not generally applicable to the limited number of forms seen in *Amanita* which, with a few exceptions, may all be grouped under Nobles' "noteworthy swellings on hyphae". The majority of isolates key out further on the basis of negative attributes, i.e. conidia, chlamydospores, oidia lacking; reverse unchanged in color; plates not covered in 6 weeks. The result is a large group of isolates with identical key codes but with often unique, uncoded characters.

An attempt to formulate a key pattern specific for *Amanita* was made, but this encountered difficulties. Consistency was found to be lacking between isolates of the same species, not only in growth rate, but also in hyphal forms, special structures, mat characters, and odor. Of the three isolates of *Amanita muscaria*, all collected in Nova Scotia, one was strikingly dissimilar in rate of growth, appearance of mat, and in the absence of a diffusion zone on tannic acid agar. The classical taxonomy of this species is presently undergoing investigation (Jenkins, 1974) to identify and verify infraspecific taxa, and a definitive statement cannot be made here concerning the disparate isolate. Possibly this isolate was a "variety" of *A. muscaria* with subtle sporocarp differences, or perhaps such cultural characters represent a real, but hitherto unrecognized, character field for separation of "taxa" now passing under single nomenclatural designations.

Amanita citrina f. *lavendula,* highly distinctive from *A. citrina* in culture, is not as readily distinguished from *A. citrina* by classical taxonomic characters. In fact, it was the wide disparity in cultural characteristics which prompted reexamination of the voucher fruit bodies, where one collection was identified as *A. citrina* f. *lavendula* (exhibiting an abrupt, pinkish-lavender volva and smaller spores, 4-6 μ diam vs. 7.5-9 μ diam in the typical form).

Variability in the three cultures of *Amanita "flavoconia"* was likewise found to correspond to disparities among the fruit bodies. Two isolates (see above) were very similar in cultural characteristics and growth rates, while their sporocarps possessed the identical amyloid, elliptical spores. A third isolate under the same name was outstanding because of its comparably rapid growth, different mat color and texture, and minimal hyphal differentiation. Upon reexamination, the sporocarp of this isolate was found to have globose to subglobose spores as well as deeper orange color on the dried pileus.

Bas (1969) considers *Amanita strobiliformis* a European species; isolate no. DJ725 is therefore placed in his section *Lepidella* with recognition of its affinities for, but not conspecificity to that species.

After comparing the growth rates and the occurrence of taxonomically important features in these isolates on three different media, PDA must be considered the reference agar of choice, preferable to both MA and MA+. Of the 12 isolates in culture, 7 showed maximum growth on PDA, compared to 3 on MA, and 2 on MA+. (See Table 1) In addition, mat color, texture, and topography on PDA were frequently in sharp contrast to mats of the same isolate on MA and MA+.

Moreover, while hyphal types characteristic of a species, i.e. vesicular, moniliform, helicoid,

TABLE 1

DIAMETER OF COLONY AFTER 6 WEEKS (IN MM)

SPECIES	MA	MA+	PDA
Amanita citrina	4	4	6
Amanita citrina f. *lavendula*	100+	92	33
Amanita flavoconia	16-20	11-13	19-21
Amanita sp. (affin. *flavoconia*)	40	17	40
Amanita muscaria	5-6,(23)	5-6,(30)	2-8,(19)
Amanita polypyramis	78	66	64
Amanita rubescens	50	44	40
Amanita sp. (affin. *strobiliformis*)	0	1	22
Amanita velatipes	8	19	35

undifferentiated, generally occurred on all three media, unique structures sometimes occurred only on PDA. *Amanita "strobiliformis"*, thin-walled and consistently without clamp connections on MA, exhibited rare clamp connections on PDA. Although *Amanita citrina* f. *lavendula* was notable on MA for having basidia and blastospores, aggregations considered as an incipient hymenium were found on PDA, equally valid as a taxonomic character. Differential growth on PDA and MA suggests the possibility of cultural characterization on other favorable media, such as W. L., Mycological (Difco) (Stark, personal communication) KHO, and cherry agar (Semerdzieva, 1966).

The vitamin supplement in MA+ enhanced growth over MA in only 2 of 12 isolates and had a negligible or inhibitory effect in the remaining isolates. Mat characteristics on MA+ were usually indistinguishable from those on MA and microscopic features were never distinctive.

These examples lend further support to combining cultural taxonomy with classical taxonomy for more comprehensive species descriptions. Further studies, utilizing larger numbers of cultures and taxa from wider geographical ranges would appear potentially profitable.

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BOOK REVIEWS *(continued from page 238)*

ici les mycologues, lichénologues, phytopathologues et tous ceux qui, en étudiant, amateur ou spécialiste, désirent étudier et décrire des fungi.

THE LICHENS, édité par Vernon AHMADJIAN et Mason E. HALE, xiv + 697 p., illustr., 16 x 24 cm, relié. Academic Press Inc., 24-28 Oval Road, London NW1, 1973. $38.00.

Ce livre, composé par 23 spécialistes, rassemble toutes les connaissances actuelles sur la structure, le développement, la physiologie, la chimie, l'écologie, la taxonomie des lichens. Ce n'est toutefois pas une encyclopédie, mais une synthèse très élaborée, selon un plan logique.

Les différentes parties concernent successivement
(1) la forme, l'anatomie et le développement (H.M. Jahns), une évaluation taxonomique des caractères morphologiques (J. Poelt), la reproduction sexuelle (M.A. Letrouit-Galinou), les propagules (F.B. Pyatt) et la structure fine des lichens (E. Peveling) (182 p.);
(2) la physiologie (125 p.), en particulier le métabolisme des hydrates de carbone et de l'azote;
(3) la réponse à l'environnement (185 p.) avec les relations lichen-eau (O.B. Blum), lichen-substrat (I.M. Brodo), lichen-pollution de l'air (O.L. Gilbert) et croissance (M.E.Hale);
(4) les produits de métabolisme (70 p.);
(5) les interactions symbiotiques (35 p.) avec la synthèse des lichens (V. Ahmadjian).
Trois chapitres, mis en appendice parce que techniques sans doute, sont aussi intéressants: la classification des lichens (J. Poelt), les méthodes d'isolement et de culture (V. Ahmadjian) et l'étude des substances licheniques (J. Santesson).

On regrettera peut-être que les considérations sur la classification des lichens n'ont pu être poussées au delà des familles ni assorties de clés des familles et des genres.

Ce "traité des lichens" est, par beaucoup d'aspects, comparable au THE FUNGI de Ainsworth, Sparrow et Sussman et le complète très bien.

INDEX TO FUNGOUS AND LICHEN TAXA

The Index includes genera, infrageneric taxa, species, and infraspecific taxa. New taxa are in CAPITALS, and the pages where they are published are in *italics*. (The list of epithets on pp. 173-187 is not indexed here.)

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MYCOTAXON

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POLYPORACEAE OF NORTH AMERICA
THE GENUS TYROMYCES[1]

JOSIAH L. LOWE

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SUMMARY

Forty-eight species are accepted as valid to the flora of North America. These are fully described, and thirteen more are briefly described that have been placed in the genus *Tyromyces* or could be easily mistaken for members of that genus. Fifteen new combinations are made into the genus, and twelve species or varieties are reduced to synonomy with the valid species. A key to all species treated is included.

---

[1] In this manual 48 species are accepted as valid to the flora of North America, and 12 new combinations are made into *Tyromyces* from *Polyporus*, namely *amarus*, *canadensis*, *croceus*, *delectans*, *hydrophilus*, *lapponicus*, *lineatus*, *semistipitatus*, *spumeus* var. *malicola*, *substuppeus*, *trichrous*, and *transmutans*; one from *Boletus*, namely *unicolor*, one from *Poria*, namely *illudens*, and one from *Trametes*, namely *humeana*. Synonomy, apparently for the first time, includes *Coriolus ochrotinctellus* as a synonym of *Tyromyces duracinus*, *Polyporus angolensis*, *P. pseudosulphureus*, and *P. sublutescens* as synonyms of *T. trichrous*, *P. grantii* as a synonym of *T. guttulatus*, *P. abieticola* as a synonym of *T. illudens*, *Scutiger tisdalei* as a synonym of *T. graminicola*, *T. cinchonensis* as a probable synonym of *T. floriformis*, *T. gloeocystidiatus* and *T. newellianus* as synonyms of *T. leucomallellus*, *T. tigertianus* as a synonym of *T. humeana*, and *P. tephroleucus* var. *scruposus* reduced to the species.

The Polyporaceae is a family of Homobasidiomycetes with about 3000 described species of which Ainsworth (1971, p. 475) estimates there are about 600 valid species. These fungi grow almost exclusively on wood and consequently are of great economic importance. Until rather recently this highly diverse group could be placed into 8 genera based on characteristics readily visible to the naked eye. The steadily increasing use of the microscope in polypore taxonomy led to proliferation of genera, with far more restrictive generic concepts, so much so that Donk (1960) could discuss more than 270 genera that have been proposed for the Polyporaceae.

ECONOMIC IMPORTANCE

Some polypores are major destroyers of standing and down timber, but none of the species of Tyromyces treated here are of such economic importance. They are predominantly beneficial as slash destroyers. Perhaps only one, T. amarus on incense cedar (Libocedrus decurrens Torr.), can be considered of real importance on its highly specific host which grows in a limited area in Oregon and California.

DISTRIBUTION

Distribution records for temperate North America are based on those of Overholts (1953), with supplements from my studies. These records are considered reasonably complete. Records from tropical North America are based on specimens studied and these are decidedly incomplete, both because relatively little collecting has been done there, and because of the unsatisfactory state of the taxonomy of tropical species. It appears well-established that many tropical species have a wide distribution, often however known only from widely separated stations.

MORPHOLOGY OF THE SPOROPHORE

The sporophore consists of the supporting tissue, the context, and the tubes below the context. As these sporophores are annual, there is only one layer of tubes. The upper surface may have projecting hairs, making a tomentose, fibrillose, or strigose upper surface which, in many species, mats down on drying to form a thin pellicle. The context tissue may be homogeneous or, in a few species formerly placed in the genus Spongipellis, show a more or less distinct layering of softer tissue above firmer tissue which is continued into the tubes. Context hyphae may be radially oriented and the context is often somewhat fibrous, or the hyphae are without particular orientation and so form a somewhat felty tissue. Changes on bruising or drying may be marked, and are good specific characters.

The hymenial characters are of paramount importance. Spore characteristics are so important that it is recommended that sterile specimens be discarded without hesitation, as certain identification cannot be made if the spore characters cannot be obtained. Sterile hymenial structures, such as cystidia, are of diagnostic importance; fortunately they are usually abundant and characteristic.

The hyphae of Tyromyces (Plate I) mostly fall readily into the three hyphal systems defined by Corner (1932a, 1932b; 1953). Generative hyphae are the kind that emerge from germinated spores, and from which all other types arise. The presence of clamp connections is considered an unmistakable indication of generative hyphae, which may be thin- to thick-walled, or apparently solid. Sometimes clamp connections are very rare and then it is difficult, perhaps never wholly certain, whether a rarely branched hypha is a rarely clamped generative hypha, or a nonseptate skeletal hypha which differs primarily in the absence of cross walls. Binding hyphae differ from skeletal hyphae in being much branched, but there are intergradations. With experience these distinctions can be made with considerable certainty. These types of hyphae form hyphal systems in the sporophore which, in Tyromyces, may have one or two systems. In this manual the arrangement of the species depends in large measure on the hyphal systems, as all hyphal systems are usually available, although the generative system may be autodigested in the drying process except in the extreme margin. Systems are reasonably consistent, but they do vary, just as all other taxonomic characters vary.

Species may have one, two, or three hyphal systems, and are said to be monomitic, dimitic, or trimitic. The sporophore of a monomitic species consists of a system of generative hyphae, a condition usually easy to recognize. A dimitic species offers more difficulties, as the additional type of hypha, skeletal or binding, may be either in the context, in the trama, or in both. Similarly a trimitic species, with systems of generative, skeletal, and binding hyphae, may have different systems in the context and in the trama, and offers particular difficulties when one system, usually binding, is poorly developed. The area just above the tubes must be studied, as it may have a system different from the upper half of the context.

METHODS

The descriptions are based on type specimens, where found, supplemented by study of additional material as available. Species whose types are not in existence conform to the current concepts of these in Europe and America, as exemplified by material determined by the leading students of the Polyporaceae.

Methods for morphological study of polypore sporophores have been presented exhaustively by Overholts (1929), Singer (1962), and Teixeira (1962), so will be briefly treated here. Notes on the color, texture, taste, and odor should be taken when the specimen is collected, and then it should be dried quickly. Macroscopic characteristics are based on those seen with the naked eye or with the aid of a low power stereoscopic microscope. Microscopic characteristics were secured in part by study of free-hand sections cut mostly parallel to the course of the hyphae, placed in 95% ethyl alcohol to remove air, then in 2% potassium hydroxide solution to swell the tissue to normal size. For hyphal studies doubtless the best method is dissection as recommended by Corner (1932a; 1953), but few will have the manual dexterity to follow this procedure. It is generally adequate to mount a minute piece of the context about the size of a pinhead or smaller in the mounting medium, add a drop of one percent solution of phloxine, tease apart as much as practicable with a pair of fine needles, then squash under a cover

---

Plate I. Hyphal systems in the tissues of various species of polypores. A, simple-septate generative hyphae of _T. mollis_. B, rarely branched nodose-septate generative hyphae of _T. tephroleucus_. C, rarely to often branched generative hyphae of _T. canadensis_. D, hyphae of _T. duracinus_ somewhat doubtfully considered skeletal hyphae. E, skeletal and binding hyphae of _Polyporus semipileatus_. F, bovistoid binding hyphae of _Trametes squalens_. G, bovistoid binding hyphae of _T. amygdalinus_. H, much branched generative hyphae of _T. albellus_.

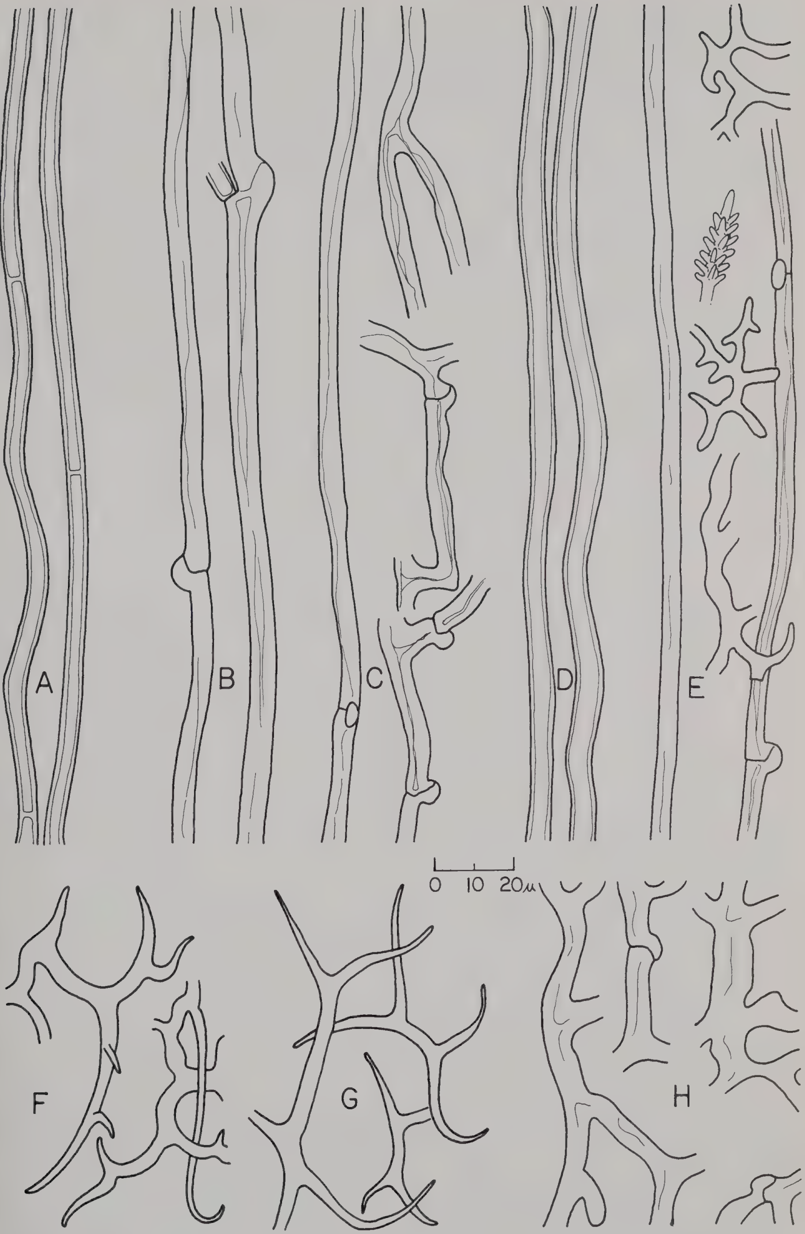

A
B
C
D
E
0 10 20µ
F
G
H

PLATE I

glass. For tramal studies a thin longitudinal section is made, that mounted and squashed as above. To determine the amyloid or dextrinoid reaction sections were mounted in Melzer's reagent (Ainsworth 1971, p. 362).

NOMENCLATURE AND TAXONOMY

The genus *Tyromyces* was proposed by Karsten in 1881, with *Polyporus chioneus* Fries cited as the type species for the genus. The most common current European concept of *P. chioneus* is that presented here under the name *Polyporus semipileatus*. In an attempt to determine Karsten's concept of *P. chioneus* seven specimens so identified by Karsten were borrowed from his herbarium at Helsinki. These proved to be a heterogeneous lot, three of them *Tyromyces tephroleucus* of this manual, two other identifiable species, and two unidentifiable. For the concepts of this manual *T. tephroleucus* is considered a characteristic species for the genus *Tyromyces*.

The genera *Amylocystis*, *Amylosporus*, and *Climacocystis* are considered synonyms of *Tyromyces*, as they are based on a positive chemical reaction to Melzer's solution, a distinction not considered of generic value. *Aurantiporus* differs only in the color of the sporophore from typical specimens of *Tyromyces*. *Leptoporus* much more justifiably could be considered worthy of generic rank, as its type species (*T. mollis*) is the only species with simple-septate generative hyphae. *Parmastomyces* is based primarily on chemical reactions in the spores, distinctions not considered of generic value. *Spongiporus* differs from typical *Tyromyces* only in having a distinctly softer texture, particularly in the upper half of the context. *Spongipellis* differs similarly though less markedly.

ACKNOWLEDGMENTS

Grateful acknowledgment is made to the directors or curators of the herbaria cited on page 7 for the opportunity to study specimens at their institutions or through loans. Invaluable financial aid was given by several grants from the National Science Foundation, for both field work and travel to herbaria. A cooperative project involving cultures of wood-decay fungi has been continued since 1947 with the Forest Service of the United States Depart-

ment of Agriculture. Special recognition is due the administrative officials of the National Fungus Collections at Beltsville, Maryland, for financial aid and extensive assistance in other ways. Invaluable aid was rendered by D. N. Pegler of the mycological staff of Kew Herbarium. He was employed to provide macroscopic descriptions and sections of the tubes and context of selected types. The latter were studied microscopically and complete notes were returned to Kew to be filed with the specimens. Restudy was occasionally necessary, for a variety of reasons, and the completeness of the descriptions reflects to a considerable degree his expert assistance. D. Reid also of Kew gave valuable assistance.

Particular acknowledgment is made to R. L. Gilbertson for a careful reading of the manuscript and to E. C. Setliff for numerous constructive suggestions.

DESCRIPTIONS AND KEYS

The Polyporaceae include those Homobasidiomycetes whose hymenium lines the walls of coherent tubes, and those polypores that are white or bright-colored, fleshy, characteristically sessile, and with hyphae in one or two systems (following Pegler 1967, p. 33), are placed in the genus Tyromyces.

The present location of type material is indicated after the citation of the original description. The first herbarium listed [1] contains the type unless qualified; the additional listed ones contain isotype material. Synonomy is based upon study of types or the most authentic material available unless otherwise noted. The listing includes only specimens studied; additional isotypes no doubt exist, particularly in European herbaria not visited, or whose contents could not be examined in detail.

---

[1] Herbarium abbreviations, with two exceptions, are those of the Index Herbariorum (Lanjouw and Stafleu 1964). They are: BFDL, Center for Forest Mycology Research, Forest Products Laboratory, Madison, Wis. 53705; BPI, National Fungus Collections, Plant Industry Station, Beltsville, Maryland 20705; CUP, Dept. of Plant Pathology, Cornell University, Ithaca, N. Y. 14850; DAOM, Mycological Herbarium, Plant Research Institute, K1A:0C6 Ottawa 3, Ontario, Canada; FH, Farlow Library and Herbarium of Cryptogamic Botany, Harvard University, Cambridge, Mass. 02138; FLAS, Dept. of Botany, Univ. of Florida, Gainesville, Fla. 32601; K, The Herbarium and Library, Royal Botanic Gardens, Kew, Richmond, Surrey, England; MICH, University Herbarium, Univ. of Michigan, Ann Arbor, Mich. 48104; NY, New York Botanical Garden, New York, N. Y. 10458; NYS,

In the serial references, the word order is that used in the UNION LIST OF SERIALS, edit. 3.

TYROMYCES P. Karst.

Rev. Myc. 3(9):17. 1881. Leptoporus Quél., Ench. Fung., p. 175. 1886. Spongipellis Pat., Hym. Eur., p. 140. 1887. Aurantiporus Murr., Torrey Bot. Club Bull. 32: 487. 1905. Spongiporus Murr., same reference but page 474. Amylocystis Bond. & Sing. in Singer, Mycologia 36:67. 1944. Climacocystis Kotl. & Pouz., Česká Myk. 12:95 and 103. 1958. Parmastomyces Kotl. & Pouz., Fedde's Repertorium 69(2):138. 1964. Amylosporus Ryv., Norw. Jour. Bot. 20:1. 1973.

Type species: Polyporus chioneus Fries.

Annual, on wood, typically effused-reflexed to sessile, occasionally resupinate or laterally substipitate, fleshy or fleshy-tough drying firm or fragile; context white or rarely somewhat bright-colored when fresh, homogeneous or zonate, in some duplex; tube walls mostly becoming thin; sporophore monomitic with nodose-septate generative hyphae (but one species with simple-septate hyphae), or dimitic with additional either skeletal or binding hyphae; cystidia absent or more rarely present; spores hyaline, smooth, inamyloid or in a few species amyloid or dextrinoid.

In this manual Tyromyces tephroleucus is considered a representative species for the genus Tyromyces.

Herbarium, New York State Museum, Albany, N. Y. 12224; PAC, Buckhout Laboratory, Pennsylvania State Univ., University Park, Pa. 16802; PC, Muséum de Histoire Naturelle, Laboratoire de Cryptogamie, 12 Rue de Buffon, Paris V, France; PR, Botanical Department of the National Museum, Prague, Czechoslovakia; S, Botanical Department, Naturhistoriska Riksmuseum, 104 05 Stockholm 50, Sweden; and SYRF, Department of Forest Botany and Pathology, State University of New York, College of Environmental Science and Forestry, Syracuse, N. Y. 13210.

KEY TO THE SPECIES

1. Distinctive sterile elements present in the hymenium 2

1. Such sterile elements absent from the hymenium 6

  2. Context up to 2 cm thick 3

  2. Context not over 1 cm thick, mostly much thinner 4

3. Sporophore reddish on bruising or drying; spores cylindrical to cylindric-ellipsoid, 8-10 x 2.5-3.5 μ .... 13. *T. lapponicus*

3. Sporophore not becoming reddish; spores ellipsoid to ellipsoid-oval, 5.5-7 x 4-5 μ .... 35. *T. borealis*

  4. Pores 9-10 per mm; cystidia heavily incrusted . 34. *T. semisupiniformis*

  4. Pores 1-6 per mm; cystidia not heavily incrusted 5

5. Gloeocystidia present; spores cylindrical, 4.5-8 x 1-2 μ .... 17. *T. leucomallellus*

5. Gloeocystidia absent; cystidia up to 15 μ in diam; spores amyloid, oval to subglobose, 2.5-3 μ long .... 36. *T. illudens*

5. Gloeocystidia absent; cystidia fusoid, smaller; spores inamyloid, oblong, 4-6 μ long .... 46. *T. balsameus*

  6. Sporophore white or yellowish, turning red on bruising or drying 7

  6. Sporophore not markedly red on bruising or drying 11

7. Hyphae simple-septate .... 1. *T. mollis*

7. Hyphae nodose-septate 8

  8. Spores dextrinoid 9

  8. Spores not reacting to Melzer's solution ... 10

9. Soft-tomentose to hispid above; taste very disagreeable .... 16. *T. transmutans*

9. Glabrous above; taste slightly acid ... 15. *T. subcartilagineus*

  10. Context not over 1 mm thick; changing color only slightly where bruised when fresh .... 45. *T. lowei*

  10. Context up to 10 mm thick; quickly red where bruised and red on drying 14. *T. fragilis*

11. Sporophore more or less pendent 12
11. Sporophore effused-reflexed or sessile, or laterally attached 14
12. Pores 6-8 per mm .... 24. *T. subpendulus*
12. Pores 2-4 per mm 13
13. Usually soft and cottony when fresh, small ... 25. *T. minusculoides*
13. Soft but tough when fresh, much larger ... 26. *T. cerifluus*
14. Spores ellipsoid to subglobose or, if appearing more narrow, not over 5.5 µ long 15
14. Spores cylindrical to ellipsoid or, if appearing broader, 6 µ or more long 35

SPORES ELLIPSOID TO GLOBOSE

15. Spores rarely over 3 µ wide 16
15. Spores usually over 3 µ wide, usually much more 24
16. Pores usually not over 5 per mm 17
16. Pores usually 5 or more per mm 21
17. Pores 1-3 per mm, rarely more 18
17. Pores 3-5 (-6) per mm 19
18. Pores 1-2 per mm; matted-tomentose above; spores probably 5 x 3 µ; trimitic ... 58. *Spongipellis luridescens*
18. Pores 2-4 per mm; velvety to glabrous above; spores 3-5.5 x 2.5-3.5 µ; monomitic .... 12. *T. humeana*
19. Minutely pubescent to glabrous above; pore surface usually with a greenish tint ... 2. *T. fumidiceps*
19. Hirsute to strigose above, becoming matted when dry; pore surface white to cream 20
20. On angiosperm substrata; southern; monomitic .... 11. *T. pseudolacteus*
20. On gymnosperm substrata; northern; dimitic; spores amyloid; cystidia often inconspicuous .... 36. *T. illudens*
21. Sporophore to 3 cm thick; sporophore monomitic .... 3. *T. galactinus*
21. Sporophore not over 1 cm thick 22

22. Pileus glabrous above, not over 4 mm thick .... 37. *T. semisupinus*

22. Pileus tomentose, strigose, fibrillose, or matted above; to 8 mm thick 23

23. Pores 4-6 per mm; northern, on wood of gymnosperms; context monomitic, trama dimitic .... 32. *T. canadensis*

23. Pores 8-10 per mm; tropical; context dimitic, trama monomitic .... 33. *T. hydrophilus*

24. Pores 1-2(-3) per mm or larger 25

24. Pores 2-5 (-6) per mm 28

25. Context drying firm to hard throughout 26

25. Context soft above, firmer below 27

26. Context drying conspicuously zonate, often with chlamydospores; applanate to subungulate .... 4. *T. fissilis*

26. Context drying azonate, without chlamydospores; ungulate ... 7. *T. amarus*

27. Pores 1-2 per mm; hyphae thin-walled in upper part of context .... 5. *T. delectans*

27. Pores 1 per mm or larger; context hyphae thick-walled throughout .... 6. *T. unicolor*

28. Spores 2.5-4 μ wide 29

28. Spores usually 4 μ or more wide 31

29. Sporophore drying very light in weight; context to 2 cm thick 30

29. Sporophore not markedly light; context usually 2 mm or less thick . 9a. *T. spumeus* var. *malicola*

30. Spores amyloid; hyphae 2.5-14 μ in diam .... 39. *T. graminicola*

30. Spores inamyloid; hyphae 2-7 μ in diam .... 38. *T. trichrous*

31. Sporophore buff to orange when fresh, fading on drying; tubes darkening and agglutinating on drying .... 8. *T. croceus*

31. Sporophore white, often discoloring somewhat on drying; tubes not collapsing and not agglutinating on drying 32

32. Fibrillose to strigose above, often drying matted; context monomitic 33

32. Appressed-tomentose or velvety to glabrous above; context di- or trimitic 34

33. Sporophore up to 4.5 cm thick; tissue near the tubes drying firm and radially fibrous, the tubes drying firm-waxy to rather soft and fragile; spores 5-6 μ broad ... 9. *T. spumeus* var. *spumeus*

33. Sporophore up to 0.8 cm thick; tissue near the tubes drying cartilaginous, the tubes drying rigid and more or less translucent, up to 1.5 mm long; spores 4-4.5 μ broad ... 10. *T. substuppeus*

34. Pileus conchate, cream color, to 0.3 cm thick .... 48. *T. semistipitatus*

34. Pileus applanate to convex, often in part blackening on drying, to 3 cm thick .... 57. *Polyporus spraguei*

SPORES CYLINDRICAL TO ELLIPSOID

35. Pores 6-10 per mm 36

35. Pores 1-6 per mm 42

36. Spores 0.5-2 μ wide 37

36. Spores 2-3 μ wide 40

37. Spores 0.5-1.5 μ wide 38

37. Spores 1.5-2 μ wide 39

38. Spores 0.5-1 μ wide; sporophore trimitic ... 51. *Polyporus semipileatus*

38. Spores 1-1.5 μ wide; sporophore monomitic ... 22. *T. leucomallus*

39. Skeletals mostly thin-walled; laterally attached by a narrowed base; generative hyphae 2.5-6 μ in diam .... 40. *T. duracinus*

39. Skeletals thick-walled; effused-reflexed to sessile; generative hyphae 2-3 μ in diam ... 41. *T. versicutis*

40. Spores 4-5 μ long; sporophore monomitic ... 30. *T. albogilvus*

40. Spores 5.5-8 μ long; sporophore trimitic .. 41

41. Spores 5.5-7.5 μ long; pores 6-8 per mm; sporophore white to cream . 53. *Polyporus nivosus*

41. Spores 6.5-8 μ long; pores 8-9 per mm; sporophore distinctly darker ... 52. *Polyporus fulvitinctus*

42. Spores rarely over 1.5 μ wide, usually bent and more or less allantoid 43

42. Spores usually 1.5 μ or more wide, mostly oblong 50

43. Pores 1-3 per mm; margin undulate . 44. *T. undosus*
43. Pores (2-) 3-6 per mm 44
44. Context not over 2 mm thick 45
44. Context much thicker, to 45 mm thick 46
45. Above white, finely tomentose to glabrous; pores 4-6 per mm; taste bitter .18. *T. perdelicatus*
45. Above with yellowish fibrils; pores 3-4 per mm; taste mild .... 19. *T. lineatus*
46. Very soft, particularly in upper part of context; on wood of gymnosperms at high elevations in western North America .... 23. *T. leucospongia*
46. Mostly firm; on wood of angiosperms and gymnosperms; widely distributed 47
47. Generative hyphae of context much branched; trama dimitic .... 31. *T. albellus*
47. Generative hyphae usually rarely branched; trama monomitic 48
48. With a disagreeable or bitter taste; rot brown .... 43. *T. lacteus*
48. With mild taste; rot white or brown 49
49. Above often villose to strigose; externally with more or less bluish tint .. 20. *T. caesius*
49. Above finely tomentose to glabrous, white to grayish or brownish .... 21. *T. tephroleucus*
50. Spores to 5 μ long, rarely longer 51
50. Spores usually more than 5 μ long 55
51. Taste at most slightly resinous; matted-fibrillose above .... 27. *T. carbonarius*
51. Taste disagreeable or bitter; minutely fibrillose to glabrous above 52
52. Context to 2 mm thick; tubes to 4 mm long . 53
52. Context usually much thicker; tubes to 10 mm long 54
53. Usually imbricate, often spathulate, white when fresh; monomitic .... 28. *T. floriformis*
53. Resupinate to effused-reflexed or sessile, with reddish radial streaks; dimitic. 45. *T. lowei*
54. Above typically with depressed spots, drying smooth and often with a pellicle .,............. 29. *T. guttulatus*
54. Above without spots, typically drying rough .... 42. *T. immitis*
55. Bovistoid binding hyphae present 56
55. Bovistoid binding hyphae absent 57

56. Without odor; trimitic ...59. *Trametes squalens*
56. With almond or vanilla odor when fresh; dimitic .... 47. *T. amygdalinus*
57. Pores 3-4 per mm 58
57. Pores 4-6 per mm 59
58. Spores 10-14 x 4-7 μ; sporophore 2-3 cm thick .... 61. *T. magnisporus*
58. Spores about 6-8.5 x 2.5-3.5 μ; sporophore to 1 cm thick .... 50. *T. palmarum*
59. Spores 1.5-2.5 μ wide 60
59. Spores 2.5-4 μ wide 61
60. Sporophore small, to 0.4 cm thick; above pale reddish translucent, glabrous; pores 5-6 per mm .... 49. *Polyporus obductus*
60. Sporophore medium-sized, to 4 cm thick; above white to discolored, often drying rough .... 54. *Polyporus durescens*
61. Tubes drying papery tough .... 56. *T. nivosellus*
61. Tubes drying fragile 62
62. Tubes drying rigid; mostly on wood of gymnosperms .... 55. *Polyporus palustris*
62. Tubes drying rather soft; on wood of angiosperms .... 60. *T. calkinsii*

1a. *Hyphal construction monomitic* (see also 1b and 1c)
2a. *Generative hyphae with simple septa*

1. TYROMYCES MOLLIS (Pers. ex Fries) Kotl. & Pouz.

Plate IA and Fig. 1

Česká Myk. 13:27. 1959. *Polyporus mollis* Pers. ex Fries, Syst. Myc. 1:360. 1821. *Boletus mollis* Pers., Obs. Myc. 1:22. 1796. *P. erubescens* Fries, Epicrisis, p. 461. 1836-38 of many European authors. *P. weinmanni* Fries, Epicrisis, p. 459. 1836-38 of many authors. *Tyromyces smallii* Murr., N. Amer. Flora 9:32. 1907 (NY). *Polyporus pini-ponderosae* W. H. Long, N. Mex. Chapt. Phi Kappa Phi Papers 1:3. 1917 (BPI; NY).

Sessile, solitary or imbricate, taste mild; pileus white throughout when fresh, quickly turning red where bruised and pinkish to dull red on drying, convex to subungulate, dimidiate, soft and watery when fresh, drying rigid and fragile, up to 6 x 9 x 4 cm, above finely appressed-fibrillose to matted-strigose, drying glabrous and smooth or minutely reticulate, usually with a thin pellicle, azonate, the margin rather thick, acute, below fertile to edge; pore surface dull when dry, the pores angular to sinuate, 2-3 (-4) per mm, dissepiments thin, entire to incised; tubes drying translucent, rigid and brittle, up to 6 mm long; context drying rather soft and fibrous-fragile, up to 2.5 cm thick.

Sporophore monomitic, the context of rarely branched, rather thin- to thick-walled, simple-septate generative hyphae 4-7 μ in diam; trama of similar hyphae except 3-5 μ in diam; gloeoplerous hyphae present; cystidia none; basidia clavate, 14-17 x 5-8 μ; spores hyaline, smooth, inamyloid, allantoid, 4.5-5.5 x 1.5-2 μ.

On wood of gymnosperms, widely distributed in the United States and Canada, and in Europe; associated with a brown rot. This species is an atypical member of the genus *Tyromyces*, as it is the only one having simple septa. For that reason it has been assigned to the subgenus *Leptoporus* (Quél.) Pouz. (Fol. Geobot. Phytotax. 1:370. 1966). The species is the lectotype of the genus *Leptoporus* Quél., as selected by Donk (Persoonia 1:236. 1960).

A specimen in Kew Herbarium determined by Fries as *Polyporus mollis* is *T. fragilis* as interpreted in this paper. The interpretation of *T. mollis* as here presented stems from Romell (Sv. Bot. Tidsk. 6:639. 1912 - specimen at S). This concept is the same as in Overholts (1953, p. 277) and in Teston (1953, p. 84 , as *Leptoporus erubescens*).

2b. *Generative hyphae nodose-septate*
  3a. *Spores ellipsoid to globose or, if appearing more narrow, not over 5.5 μ long*
    4a. *Spores 4 μ or less long*

2. TYROMYCES FUMIDICEPS Atk. Fig. 2

Ann. Myc. 6:61. 1908 (CUP). *Polyporus smaragdinus* Lloyd, Myc. Writ. 5:818. 1919 (BPI; PAC).

Effused-reflexed to sessile, solitary to somewhat imbricate, occasionally fragrant, mild in taste, after long storage often covered with whitish crystals; pileus convex, dimidiate, watery-fleshy to soft and spongy, drying firm, up to 3 x 7 x 1 cm, above whitish or more often grayish or brownish, minutely pubescent to glabrous, azonate, often drying with a thin pellicle, the margin acute, below fertile to edge; pore surface white or pale greenish and usually greenish where bruised, drying cream or with a greenish tint, dull to faintly glancing, the pores angular, 3-5 per mm, dissepiments thin to thick, more or less fimbriate; tubes white or pale lemony, drying soft and fragile, up to 4 mm long; context white to grayish, soft and fragile in the upper half, firmer and radially arranged below, up to 6 mm thick.

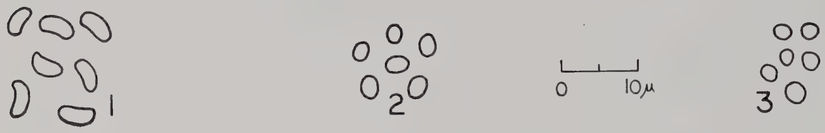


Fig. 1. Spores of T. mollis from CUP 5106 at NY. Fig. 2. Spores of T. fumidiceps from type, CUP 22073. Fig. 3. Spores of T. galactinus from Martin 483 at BPI.

Sporophore monomitic, the context of rarely to often branched, thin-walled to more often thick-walled, nodose-septate generative hyphae 3-6 (-7) μ in diam; trama of similar hyphae except 2-4 μ in diam; gloeoplerous hyphae rare, 4-7 μ in diam; hyphal pegs occasional; cystidia none; basidia clavate, 13-21 x 5-6 μ; spores hyaline, smooth, inamyloid, broadly ellipsoid to oval, 2.5-3 (-3.5) x 2-2.5 (-3) μ.

On wood of angiosperms in areas subject to flooding, in Ont., N.Y., Mich., Miss., and Ark., reported in addition by Overholts (1953, p. 306) from Pa., N.J., Del., Md., Tenn., Ohio, Mo., and Quebec. The greenish color of the tubes is unusual in polypores, as is the abundant production of whitish crystals covering the sporophore in stored specimens

Tyromyces avellanealbus Murr., Torrey Bot. Club Bull. 65:657. 1939 (at FLAS; BPI; SYRF) is an abnormal myriadoporous form similar to T. fumidiceps but perhaps differing in having a slowly developing acrid taste. Described from Florida.

3. TYROMYCES GALACTINUS (Berk.) Bondartsev Fig. 3

Polyporaceae Europe, USSR and Caucasia, p. 189. 1953. Polyporus galactinus Berk., London Jour. Bot. 6:321. 1847 (K; BPI; ?NY). P. iowensis Lloyd, Myc. Writ. 7:1363. 1925 (BPI).

Sessile, imbricate or solitary, with a fragrant odor when fresh, taste mild; pileus convex, dimidiate, watery when fresh, rigid when dry, up to 8 x 10 x 3 cm, above white to gray and tomentose to strigose near base, drying usually yellowish, rough, azonate, the margin thin to obtuse, edge often drying cartilaginous, with a narrow sterile band below; pore surface drying yellowish, pores angular, (4-) 5-6 per mm, dissepiments thin, entire to fimbriate; tubes drying brittle, up to 12 mm long; context drying more or less duplex, upper half soft-fibrous, becoming very firm or cartilaginous in the lower half, often zonate, up to 2 cm thick.

Sporophore monomitic, the context of both frequently branched, thin-walled, nodose-septate generative hyphae 4-7 μ in diam and of similar except rarely branched hyphae in strands; trama of similar hyphae except 2.5-5 μ in diam; cystidia none; basidia clavate, 12-17 x 5-7 μ; spores hyaline, smooth, inamyloid, broadly ellipsoid to oval, 2.5-3 x 2-2.5 μ.

On wood of angiosperms in the eastern half of the United States and Canada.

This species is very similar to T. spumeus var. malicola which differs only in having larger spores, 4-5 x 3.5-4 μ, and that variety intergrades with T. spumeus which typically has still larger spores 6-8 x 5-6 μ.

4b. Spores usually 4 μ or more long, usually much more
    5a. Pores mostly 1-3 per mm

4. TYROMYCES FISSILIS (Berk. & Curt.) Donk Fig. 4

Utrecht Rijksun. Bot. Mus. Meded. 9:153. 1933. Polyporus fissilis Berk. & Curt., Jour. Bot. and Kew Misc.

1:234. 1849 (K). P. albosordescens Rom., Sv. Bot. Tidsk. 6:637. 1912 (S; BPI). Polyporus fuscomutans Lloyd, Myc. Writ. 7:1158. 1922 (BPI; K).

Sessile, solitary to subimbricate, without distinctive odor or taste, drying relatively heavy; pileus applanate to subungulate, dimidiate to flabelliform, up to 10 x 17 x 7 cm, above white, drying brownish discolored, minutely spongy-tomentose, drying wrinkled and strigose or fibrillose to subglabrous, azonate, the margin rather thin to thick, fertile below to edge; pore surface white to pale pink, drying brownish yellow or darkening to black, the pores angular, 1-3 per mm, dissepiments thin, entire; tubes becoming resinous and collapsing into a rigid dark brown to black mass on drying, up to 2 cm long; context white and watery when fresh, sometimes duplex, drying sordid, fibrous, very hard and conspicuously zonate, up to 6 cm thick.

Sporophore monomitic, the context of infrequently branched, thin- or mostly thick-walled, nodose-septate generative hyphae 4-8 μ in diam; large numbers of imbedded oval chlamydospores usually present, 3.5-6 μ in diam; trama of similar hyphae except thin-walled and 2.5-5 μ in diam; gloeoplerous hyphae present; hyphal pegs present; cystidia none; basidia cylindric, 17-24 x 5-7 μ; spores hyaline, smooth, inamyloid, apiculate, oval to subglobose, 4-7.5 x 3-6.5 μ.

On the wood of angiosperms from Ontario to Florida and westward to the Mississippi River; associated with a speckled white rot, see Boyce (1961) and Hepting (1971). The sporophore most nearly resembles that of T. croceus which differs in being distinctly orange when fresh, in lacking chlamydospores in the context, drying darker, with pores 3-5 per mm, and lacking gloeoplerous hyphae.

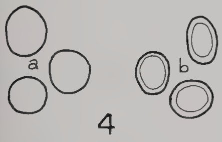
5. TYROMYCES DELECTANS (Peck) Lowe, comb. nov. Fig. 5

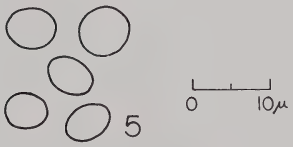
Polyporus delectans Peck, Torrey Bot. Club Bull. 11:26. 1884 (NYS; BPI; FH; ?NY). Trametes krekei Lloyd, Myc. Writ. 5, Letter 69:12. 1919 (BPI).

Sessile or effused-reflexed, solitary or sometimes imbricate, taste mild; pileus convex, soft, watery, and white throughout when fresh, drying firm to rigid and yellowish, up to 10 x 15 x 4 cm, above finely tomentose to almost glabrous or, on drying, becoming coarsely and roughly short-strigose, azonate, the margin usually abruptly thinning, acute; pore surface drying rough, the pores round to sinuous, 1-2 per mm, dissepiments thin, dentate to finely lacerate; tubes up to 15 mm long; context often duplex when dry, soft-fibrous above, usually firm below, azonate, up to 2 cm thick.

Sporophore monomitic, the context in the lower half of rarely branched, thin- or thick-walled, nodose-septate generative hyphae 4-7 µ in diam, upper half similar except all hyphae thin-walled; trama of similar hyphae except 3-5 µ in diam; cystidia none; basidia clavate, 19-31 x 7-9 µ; spores hyaline, smooth, inamyloid, oval to subglobose, 5-7 x 4-6 µ.

On wood of angiosperms in northeastern United States and eastern Canada, and reported by Overholts (1953, p. 320) from Oregon; associated with a white ring-shake (Overholts) or a brown rot, see Thomas and Podmore in Can. Jour. Bot. 31:675-692. 1953; also see Hepting (1971).





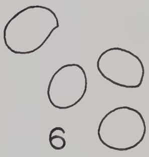


Fig. 4. Spores (a) and chlamydospores (b) of *T. fissilis* from type at K, Curtis 1441. Fig. 5. Spores of *T. delectans* from type at NYS. Fig. 6. Spores of *T. unicolor* from Meschutt collection at SYRF.

T. unicolor is very similar but it usually can be separated by its larger pores (1 per mm or larger), and uniformly thick-walled hyphae in the upper softer part of the context. *Leptoporus bredecelensis* Pilát is very similar; Bondartsev (1971, p. 243) and Dománski (1967, p. 97) give somewhat longer spores, 7-8.5 µ long.

6. TYROMYCES UNICOLOR (Schw.) Lowe, comb. nov. Fig. 6

Boletus unicolor Schw., Schr. Nat. Ges. Leipzig 1:97. 1822. Polyporus obtusus Berk., Ann. Nat. Hist. 3:390. 1839. P. tomentoso-quercinus Johns., Minn. Acad. Nat. Sci. Bull. 1:338. 1878.

Sessile, solitary, taste mild; pileus convex to ungulate, dimidiate, spongy to firm, up to 20 x 30 x 8 cm (Overholts), above white or grayish to yellowish, or drying brownish, hirsute-tomentose or rarely becoming glabrous, azonate, the margin obtuse; pore surface concolorous, dull, the pores round to angular or sinuous, 1 per mm or larger, dissepiments thin, entire to slightly lacerate; tubes drying corky, up to 3 cm long; context drying cream to very pale brown, more or less duplex, the upper part rather soft and fibrous, below firmer, faintly zonate, up to 3 cm thick.

Sporophore monomitic, the context of rarely to frequently branched, thick-walled, nodose-septate generative hyphae 4-8 μ in diam; trama of similar hyphae except often thin-walled and 2.5-7 μ in diam; cystidia none; basidia subcylindrical, 24-30 x 6-8 μ; spores hyaline, smooth, inamyloid, broadly ellipsoid to subglobose, 6-8 x 5-6 μ.

On wood of living angiosperms, widely distributed in the United States and in Ontario; the cause of a soft heartrot of oaks, see Boyce (1961) and Hepting (1971), both as P. obtusus.

Type material of P. obtusus or of P. tomentoso-quercinus have not been located.

7. TYROMYCES AMARUS (Hedgc.) Lowe, comb. nov. Fig. 7

Polyporus amarus Hedgc., Mycologia 2:155. 1910 (BFDL; BPI; K). P. libocedris von Schrenk, Science, n.s. 16:138. 1902 (nom. nudem).

Sessile, solitary, taste slowly bitter; pileus ungulate, dimidiate, up to 10 x 16 x 9.5 cm, above cinnamon when dry, "pubescent when young" (Overholts), becoming glabrous but rough, somewhat sulcate, azonate, the margin rounded; pore surface drying dark cinnamon, the pores angular, about 2 per mm, dissepiments thin, entire to more or less incised; tubes drying rigid, brittle, up to 2.5 cm long; context drying pale tan, firm, radially fissile, azonate, up to 7 cm thick.

Sporophore monomitic, the context of infrequently branched, thin- to thick-walled, nodose-septate generative hyphae 5-12 µ in diam; trama of similar hyphae except thin-walled and 2.5-6 µ in diam; gloeoplerous hyphae present; both tubes and context pale yellow in KOH solution; cystidia none; basidia cylindrical, 17-24 x 6-7(-9) µ; spores hyaline or slightly yellowish, smooth, inamyloid, ellipsoid to oval, 7-9 x 4-5.5 µ.

On the wood of incense cedar (*Libocedrus decurrens*), rarely on other gymnosperms, in Cal., Ore., and doubtfully from Idaho; associated with a brown pin rot, see Boyce (1961) and Hepting (1971).

5b. *Pores mostly 2-5 per mm*
  6a. *Pore surface orange, often drying brown-black*

8. TYROMYCES CROCEUS (Pers. ex Fries) Lowe, comb. nov.

Fig. 8

Polyporus croceus Pers. ex Fries, Syst. Myc. 1:364. 1821. *Boletus croceus* Pers., Obs. Myc. 1:87. 1796. *Polyporus pilotae* Schw., Amer. Phil. Soc. Philadelphia Trans. 2,4:156. 1832. *Polyporus hypococcinus* Berk., London Jour. Bot. 6:319. 1847. *P. castanophilus* Atk., Jour. Myc. 8:118. 1902 (CUP).

Sessile, usually solitary, without distinctive taste or odor; pileus convex to subungulate, dimidiate, watery and rather soft when fresh, rigid when dry, up to 20 x 30 x 10 cm, above buff to orange when fresh, fading on drying, minutely tomentose to glabrous, azonate, the margin usually obtuse; pore surface orange often drying brown-black, the pores angular, 3-5 per mm, dissepiments becoming thin and lacerate; tubes drying brown-black, resinous and agglutinated, up to 2 cm long; context pale buff drying sordid flesh-color to dark red, firm, fibrous, zonate, up to 3 cm thick.

Sporophore monomitic, the context of rarely branched, thin- to thick-walled, nodose-septate generative hyphae with scabrous walls, 4-6 µ in diam; trama of similar hyphae except thin-walled and mostly 3-4 µ in diam; cystidia none; basidia slender-clavate, 17-21 x 5-7 µ; spores hyaline, smooth, inamyloid, short-oblong with rounded ends to oval or ovoid, 5.5-7 x 4-5 µ.

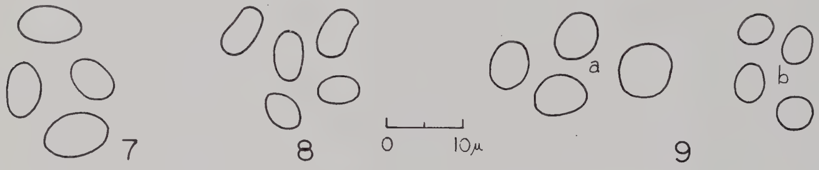


Fig. 7. Spores of *T. amarus* from isotype at BFDL. Fig. 8. Spores of *T. croceus* from FP 57092 at BFDL, BPI, and SYRF. Fig. 9. Spores (a) of *T. spumeus* from isotype of *Spongipellis occidentalis*, CUP 3346 at NY, and (b) spores of var. *malicola* from BPI, Lloyd Herb. 39895.

On the wood of angiosperms, usually chestnut and oak; associated with a piped white rot, see Hepting (1971). Dried *T. fissilis* may be mistaken for this; that species is white drying brownish discolored, has pores 1-3 per mm, and usually has chlamydospores borne in the context. *P. pilotae* is the type species for the genus *Aurantiporus*.

6b. *Pore surface white, drying yellowish- or blackish-brown*

9. TYROMYCES SPUMEUS (Sow. ex Fries) Imaz. var. SPUMEUS
Fig. 9

Tokyo Sci. Mus. Bull. 6:84. 1943. *Polyporus spumeus* Sow. ex Fries, Syst. Myc. 1:358. 1821. *Boletus spumeus* Sow., Eng. Fung. 2, t. 211. 1799. *Spongipellis occidentalis* Murr., N. Amer. Flora 9:38. 1907 (NY; CUP). *Polyporus whetstonei* Lloyd, Mycol. Writ. 7:1146. 1922 (BPI).

Sessile, sometimes somewhat imbricate, without distinctive odor or taste; pileus white throughout when fresh, applanate to convex, dimidiate, fleshy drying rigid, up to 12 x 23 x 4.5 cm, above drying cream or discolored to pale yellowish brown or grayish or reddish and hispid, fibrillose, or strigose, azonate, the margin obtuse or acute, below fertile to edge; pore surface drying medium yellowish brown, somewhat glancing, the pores angular, (2-) 3-4 (-5) per mm, dissepiments thin to thickened, usually entire; tubes drying dark tan to brown-black and rigid, firm-waxy to rather soft and fragile, up to 15 mm long; context drying pale brown, watery, usually zonate, duplex, the upper part softer than the tissue near the tubes which is firm and radially fibrous, the fibers brittle, the whole up to 3 cm thick.

Sporophore monomitic, the context of rarely branched, frequently nodose-septate generative hyphae, in the firmer portion thin- to thick-walled, upper portion thin-walled, 4-9 µ in diam, often in strands; trama of similar hyphae except 3-5 µ in diam; gloeoplerous hyphae present; cystidia none; basidia clavate, 19-24 x 6-9 µ; spores hyaline, smooth, inamyloid, oval, 6-7 (-8) x 5-5.5 (-6) µ.

On wood of angiosperms in the northern half of the United States and southern part of Canada; associated with a white rot. *T. delectans* is similar but differs in having larger pores, 1-2 per mm.

9a. TYROMYCES SPUMEUS var. MALICOLA (Lloyd) Lowe, comb. nov.

Fig. 9b.

Polyporus spumeus var. *malicola* Lloyd, Myc. Writ. 4,
Apus p. 305. 1915 (BPI).

Applanate to convex, drying yellowish throughout, up to 11 x 8 x 1 cm; much as in the species except the context usually 2 mm or less thick and the spores smaller, 4-5 x 3.5-4 µ.

On wood of angiosperms in northeastern United States, from Mass. to Minn.; associated with a white rot. The variety is much more common than the species. Compare also *Leptoporus caseosus* Pat., page 72.

The collection selected for the type is Lloyd Herb.

No. 39895, collected on apple at W. Roxbury, Mass., Oct. 1914 by A. Hibbard. The collection selected by Stevenson and Cash (No. 42675) cannot be type as it was collected more than a year after the description was published.

10. TYROMYCES SUBSTUPPEUS (Berk. & Cooke) Lowe, comb. nov. Fig. 10.

Polyporus substuppeus Berk. & Cooke, Linnean Soc. Jour. Bot. 15:380. 1876 (K; BPI; NY).

Effused-reflexed to sessile, solitary or laterally confluent, taste mild; pileus conchate to convex, dimidiate, fragile and friable when dry, up to 4 x 7 x 0.8 cm (Murrill 1907, p. 40), above pale yellowish brown, matted-tomentose to strigose, azonate, the margin recurved, obtuse, entire, below fertile to edge; pore surface brown to blackish brown, dull, the pores angular, 2-4 per mm, dissepiments thin, entire to uneven; tubes drying rigid, brittle, more or less translucent, up to 1.5 mm long; context when dry yellowish brown, duplex, upper half soft and fibrous, below firm and cartilaginous, up to 3 mm thick.

Sporophore monomitic, the context in the upper half of loosely arranged, thin-walled, nodose-septate generative hyphae 2.5-5 μ in diam, in the lower half the hyphae similar except parallel-arranged and strongly coherent; trama of similar hyphae; cystidia none; spores somewhat uncertain, probably hyaline, smooth, inamyloid, oblong with rounded ends to oval, 5-7 x 4-4.5 μ, or "ovate to broadly elliptic, slightly tinted ? stained and measure 4.75-6.2 x 3.2-4.2 (-5) μ" (Reid).

On wood in Cuba and Brazil; rot unknown. The species seems very similar to T. spumeus which is larger and with oval spores 6-8 x 5-6 μ.

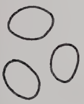
11. TYROMYCES PSEUDOLACTEUS Murr. Fig. 11.

Torrey Bot. Club Bull. 67:65. 1940 (FLAS).

Effused-reflexed to sessile, subimbricate, taste disagreeable; pileus convex, dimidiate, up to 3 x 5 x 2.5

cm, above "white", drying cream throughout, "hirsute" or strigose, or where exposed matted and forming a thin, rough pellicle, the margin acute, even; pore surface when fresh "white, unchanging", the pores angular, 4-5 (-6) per mm, dissepiments thin, entire to dentate; tubes drying soft, fragile, up to 2 cm long; context cream color, very soft and fibrous-fragile with faint strands, up to 8 mm thick.

Sporophore monomitic, the context of occasionally branched, thick-walled, frequently nodose-septate generative hyphae 3-5 (-6) μ in diam; trama of similar hyphae except 2.5-4 μ in diam; basidia clavate, 12-14 x 5-6 μ; cystidia none; spores hyaline, smooth, inamyloid, oblong-ellipsoid to ellipsoid, 4-5 x 2.5-3.5 μ from spore print (at FLAS), somewhat shorter and appearing broader in spores found on hymenium.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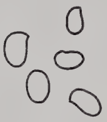
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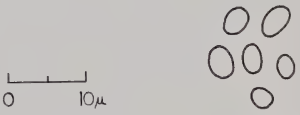

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Fig. 10. Spores, of not wholly certain origin, from type of *T. substuppeus* at K, Trail 123. Fig. 11. Spores of *T. pseudolacteus* from FLAS, F 17298. Fig. 12. Spores of *T. humeana* from type at FLAS, F 17978.

On wood of angiosperms in Florida. According to its author the sporophore suggests "*Polyporus lacteus*" of Fries which differs in having allantoid spores and a much smoother upper surface. *T. humeana* seems similar but differs in having the upper surface somewhat velvety to nearly glabrous and in having larger pores, 2-4 per mm.

12. TYROMYCES HUMEANA (Murr.) Lowe, comb. nov. Fig. 12

Trametes humeana Murr., Torrey Bot. Club Bull. 65:656. 1939 (FLAS; BPI; SYRF). *Tyromyces tigertianus* Murr., Lloydia 6:228. 1943 (FLAS).

Sessile, solitary to subimbricate, when fresh with a "strong odor of anise" and taste "with nutty flavor"

(Murrill), when dry taste somewhat disagreeable; pileus conchate to convex, dimidiate to somewhat flabelliform, up to 7 x 10 x 3 cm, above grayish or pale yellowish brown, somewhat velvety to nearly glabrous, azonate, the margin acute to obtuse, below fertile nearly to edge; pore surface "white becoming rosy-avellaneous [or brownish] where bruised" (Murrill), drying medium yellowish brown, glistening somewhat, the pores round to somewhat daedaloid or angular, (2-) 3 (-4) per mm, dissepiments somewhat thickened, entire; tubes drying soft and fragile, up to 10 mm long; context drying grayish white to pale grayish brown, rather soft and radially fibrous, up to 2 cm thick.

Sporophore monomitic, the context of rarely branched, nodose-septate generative hyphae 3-6 µ in diam, some very thin-walled and with content staining in phloxine, some with wall thickened and non-staining; trama of similar hyphae; cystidia none; basidia subcylindrical, 17-20 x 5-6 (-7) µ; spores hyaline, smooth, inamyloid, ellipsoid to oval, 3-5 (-5.5) x 2.5-3 (-3.5) µ.

On wood of angiosperms in Florida; rot unknown.

3b. Spores cylindrical to ellipsoid or, if appearing broader, 6 µ or more long
  7a. Sporophore turning red on bruising or drying
    8a. Cystidia present; spores 8-10 µ long

13. TYROMYCES LAPPONICUS (Rom.) Lowe, comb. nov. Fig. 13

Polyporus lapponicus Rom., Ark. f. Bot. 11:17. 1912 (S; BPI). *Polyporus ursinus* Lloyd, Myc. Writ. 4, Apus, p. 319. 1915 (BPI; K).

Effused-reflexed to sessile, solitary, taste mild; pileus white or pinkish throughout when fresh, on bruising or on drying darkening to reddish- or red-brown, applanate to convex, up to 5 x 10 x 2.5 cm, above fibrillose or scabrous to glabrous on drying, azonate, the margin thin, below fertile to edge; pore surface dull, the pores round to angular or sinuate, about 1-3 per mm, dissepiments thin, somewhat lacerate with age; tubes waxy-brittle when dry, up to 7 mm long; context fibrous-fragile when dry, up to 2 cm thick.

Sporophore monomitic, the context of rarely branched, thick-walled to solid, frequently nodose-septate generative hyphae 4-7 μ in diam; trama of similar hyphae except more slender, 2.5-5 μ in diam, amyloid; cystidia usually abundant and conspicuous, sometimes capitate-incrusted, amyloid or dextrinoid, cylindrical, 20-35 x 5-7 μ, imbedded or projecting to 30 μ; basidia clavate, 22-29 x 6-7 μ; spores hyaline, smooth, inamyloid, cylindrical to cylindric-ellipsoid, 8-10 x 2.5-3.5 μ.

On wood of gymnosperms in northern United States and southern Canada; associated with a brown rot, see Hepting (1971). The amyloid reaction of the cystidia with Melzer's solution led Bondartsev and Singer (Ann. Myc. 39:52. 1941) to propose a separate genus (*Amylocystis*) for this species.

8b. *Cystidia absent; spores 4-7 μ long*

14. TYROMYCES FRAGILIS (Fries) Donk Fig. 14

Utrecht Rijksun. Bot. Mus. Meded. 9:148. 1933.
Polyporus fragilis Fries, Elench. Fung. 1:86. 1828.
Spongipellis sensibilis Murr., Mycologia 4:93. 1912 (NY; BPI; K).

Sessile or more often effused-reflexed, usually solitary, taste mild; pileus when fresh white throughout but quickly turning brownish red on bruising or on drying, convex to subungulate, fleshy and rather soft when fresh, hard and fragile when dry, up to 4 x 7 x 1.5 cm, above finely tomentose to glabrous, azonate, the margin thin, below usually fertile to edge; pore surface glancing, the pores round to angular, 3-5 per mm, dissepiments thin, uneven; tubes quite soft and fragile when dry, up to 7 mm long; context drying more or less white, soft and friable, up to 1 cm thick.

Sporophore monomitic, the context of occasionally to rarely branched, thin- to more commonly thick-walled, abundantly nodose-septate generative hyphae 4-7 μ in diam; trama of similar hyphae except 3-5 μ in diam; gloeoplerous hyphae present; hyphal pegs rather rare; cystidia none; basidia clavate, 14-19 x 4-5 μ; spores hyaline, smooth, inamyloid, cylindrical and usually more or less curved and allantoid, 4.5-5.5 x 1.5-2.5 μ.

On the wood of gymnosperms, widely distributed; associated with a brown rot, see Hepting (1971). *T. mollis* and *T. lapponicus* have somewhat similar sporophores that turn red on bruising and on drying. The first is sharply distinct as its hyphae are simple-septate; the second differs in having pores 1-3 per mm, spores 8-10 μ long, and in having cystidia.

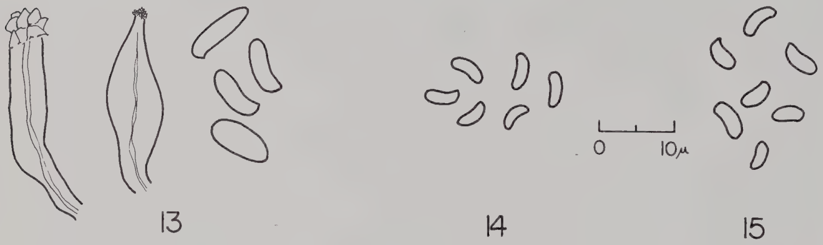


Fig. 13. Cystidia and spores of *T. lapponicus* from Lowe 3640 at SYRF. Fig. 14. Spores of *T. fragilis* from isotype of *Spongipellis sensibilis* at SYRF, Murrill 43. Fig. 15. Spores of *T. subcartilagineus*, drawing by R. Macrae from type at DAOM, No. 8852.

15. TYROMYCES SUBCARTILAGINEUS (Overh.) Dom. Fig. 15

Grzyby (Mycota), Tom. 3, p. 131. 1967. *Polyporus subcartilagineus* Overh., Mycologia 33:90. 1941 (DAOM; PAC).

Effused-reflexed to sessile, solitary to somewhat imbricate, without distinctive odor, taste slightly acid; pileus conchate to convex, dimidiate to laterally confluent, somewhat coriaceous except for a cartilaginous-crisp layer, rigid and distorted when dry, up to 1 x 8 x 0.5 cm, above white and slowly reddish where bruised, or pinkish, glabrous, azonate, the margin thin, below fertile to edge; pore surface pinkish, drying pale brown, the pores round, 3-4 per mm, dissepiments rather thin, entire; tubes drying rigid and brittle, up to 4 mm long; context with a more or less distinct cartilaginous layer above the tubes, above that white and soft, the whole up to 2 mm thick.

Sporophore monomitic, the context of rarely branched, thin- to thick-walled, frequently nodose-septate and sometimes also simple-septate generative hyphae 3-6 μ in diam; trama of similar hyphae except 2-4 μ in diam; cystidia none; basidia clavate, 16-18(-24) x (5-) 6-7(-9) μ ; spores hyaline, smooth, strongly dextrinoid, short-cylindric and bent to oblong-ellipsoid, 4-5 (-6) x (1.5-) 2-2.5 (-3) μ.

On wood of gymnosperms, widely distributed in northern United States and southward in the Rockies to Arizona and New Mexico, and in southern Canada; associated with a brown cubical rot. This is very similar to T. transmutans which seems to differ in having a larger and much thicker pileus, and a very disagreeable taste.

Pouzar (Česká Myk. 20:176. 1966) proposes T. kravtzevianus Bond. and Parm. as the more valid name for this fungus, as a Latin diagnosis has never been published for the Overholts' species. This is the type species for the genus Parmastomyces Kotl. & Pouz. (Kotlaba and Pouzar 1964 b).

16. TYROMYCES TRANSMUTANS (Overh.) Lowe, comb. nov. Fig. 16

Polyporus transmutans Overh., Mycologia 44:226. 1952 (PAC;K;SYRF).

Sessile, "odor strongly fungoid" (Overholts), with a very disagreeable taste; pileus convex, dimidiate or somewhat flabelliform, "soft and spongy when fresh, not bending without breaking" (Overholts), drying hard and brittle, up to 5 x 6 x 1.5 cm, above white to very pale buff and discoloring reddish on handling, drying more or less reddish-brown, soft-tomentose to in part hispid, azonate, the margin acute, below with a sterile marginal zone up to 1 mm in width; pore surface "creamy to very pale buff" (Overholts), when dry pink to dark reddish brown, the pores angular, 2-4 per mm, dissepiments becoming thin, dentate; tubes discoloring and agglutinating on drying, up to 5 mm long; context cream, fibrous-fragile, azonate, up to 1 cm thick.

Sporophore monomitic, the context of rarely branched, thin-walled, frequently nodose-septate generative hyphae (3-) 4-8 μ in diam; trama of similar hyphae; gloeoplerous hyphae present; cystidia none; basidia narrowly clavate, 17-24 x 5-7 μ; spores hyaline, smooth, slightly to strongly dextrinoid, oblong to oblong-ellipsoid, 5-6 (-7) x 2.5-3 μ.

On wood of angiosperms in Pa. and Mich.; associated rot unknown. Overholts reports that cultures of this are almost indistinguishable from those of *T. subcartilagineus*. The sporophores of that are similar but seem to differ in having a slightly acid taste, a glabrous upper surface, and a much thinner context with an imbedded, distinct cartilaginous layer.

7b. *Sporophore not turning red where bruised or on drying*
  9a. *Spores 1-1.5 (-2) μ wide, cylindrical, usually bent and allantoid*
    10a. *Gloeocystidia present*

17. TYROMYCES LEUCOMALLELLUS Murr. Fig. 17

Torrey Bot. Club Bull. 67:63. 1940 (FLAS). *Polyporus trabeus* Rostk. sense of Bresadola, Ann. Myc. 6:37. 1908 (S; BPI), and of Lowe and Lundell, Mich. Acad. Sci., Arts, Lett. Papers 41:21-25. 1956. *Leptoporus trabeus* (Rostk.) Bourd. & Galz., sense of Hym. France, p. 541. 1928 (PC). *Tyromyces newellianus* Murr., Torrey Bot. Club Bull. 67:64. 1940 (FLAS). *T. gloeocystidiatus* Kotl. & Pouz., Česká Myk. 18:207. 1964 (PR).

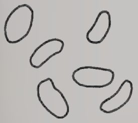
Usually resupinate and effused to 10 cm, or effused-reflexed to sessile, with an anise odor and a very disagreeable taste; pileus conchate to convex, fleshy, drying brittle, up to 3 x 4 x 1 cm, above "white" (Murrill), drying cream with reddish or brownish discoloration, matted-fibrillose to almost glabrous, azonate, the margin thin, incurved; pore surface dark cream, dull, the pores angular, about 3-4 per mm but varying from 1-6 per mm, dissepiments thin, entire to fimbriate; tubes rather soft, drying soft-fragile, up to 10 mm long; context white to cream, drying soft, friable, up to 3 mm thick.

Sporophore monomitic, the context of infrequently branched, thin- to thick-walled, nodose-septate generative hyphae 2-5 μ in diam; trama of similar hyphae; hyphal pegs present; gloeocystidia rare to abundant, usually somewhat yellowish, imbedded or projecting, up to 40 x 11 μ; basidia clavate, 12-17 x 4.5-6 μ; spores hyaline, smooth, inamyloid, cylindrical and straight to allantoid, 4.5-6 (-8) x 1-1.5 (-2) μ.

On wood of gymnosperms in eastern Canada and the United States west to Michigan, and in Manitoba; associated with a brown checked rot. Kotlaba and Pouzar (1964, p. 215) give this species a wide distribution in Europe.

Polyporus hypocitrinus Berk., Linn. Soc. Bot. 15:50. 1876, described from Brazil, is extremely similar and may be the valid name for this fungus. In the description the type was said to be centrally attached, with a citrine hymenium, and labyrinthiform pores - characters at sufficient variance with American and European material to dictate caution in proposing synonomy.

10b. *Gloeocystidia absent*
  11a. *Context not over 2 mm thick*



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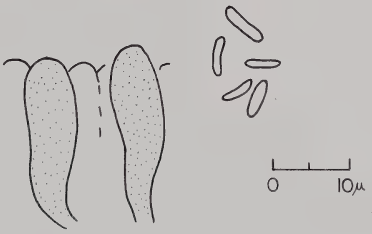

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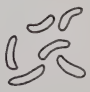

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Fig. 16. Spores of *T. transmutans* from type at PAC, Overholts Herb. 22971. Fig. 17. Spores and gloeocystidia of *T. leucomallellus* from paratype at FLAS, F 18239. Fig. 18. Spores of *T. perdelicatus* from isotype at BPI, Murrill 47.

18. TYROMYCES PERDELICATUS Murr. Fig. 18

Mycologia 4:95. 1912 (NY; BPI; FH; K).

Sessile or subresupinate, taste bitter; pileus conchate to thin-convex, soft and rather fragile, up to 1 x 2 x 0.3 cm (Overholts), above white, finely tomentose to glabrous, the margin acute; pore surface white, cream when dry, the pores angular, 4-6 per mm, dissepiments rather thin, fimbriate; tubes up to 2 mm long, when dry rather soft, fragile; context white, when dry rather soft, fibrous, up to 1 mm thick.

Sporophore monomitic, the context of rarely branched, thick-walled, frequently nodose-septate generative hyphae 2-4 μ in diam; trama of similar hyphae; gloeoplerous hyphae present; hyphal pegs present; cystidia hyphoid, 2.5-4 μ in diam; basidia clavate, 12-14 x 4-6 μ; spores hyaline, smooth, inamyloid, allantoid, 4-5 (-6) x 1-1.5 μ.

On wood of gymnosperms in Wash., Ore., Mont., and Idaho; rot unknown. The sporophore is very similar to that of T. caesius which differs in its bluish coloration, its mild taste, larger sporophores, and in having context hyphae 4-8 μ in diam.

19. TYROMYCES LINEATUS (Overh.) Lowe, comb. nov. Fig. 19

Polyporus lineatus Overh.,[1] Mycologia 33:101. 1941 (PAC; BPI; SYRF).

Sessile, laterally confluent, imbricate, taste mild; pileus convex, drying rigid, up to 1 x 3 x 0.5 cm, above with radially arranged yellowish fibrils, the margin acute, indurated, dark; pore surface tan, dull, the pores angular, 3-4 per mm, dissepiments rather thin, entire; tubes when dry indurated and brittle, up to 3 mm long; context white, soft, more or less fragile, but with yellowish indurated strands, up to 2 mm thick.

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[1] As this species has not been validated by a Latin description, a validating diagnosis is supplied here:

POLYPORUS LINEATUS Overholts sp. nov. - Pileo angusto-reflexo, 2-8 cm longo, 1-3.5 cm lato, 0.1-0.3 cm crasso, superne pallido vel cinnamomeo-luteo, tomentoso, margine lineato-radiato; contextu albo, crasso 1-2 mm; hyphis nodoso-septatis, diametro 4-5 μ; poris 2-4 pro mm; sporis cylindratis, laevibus, hyalinis, rectis, 4-5 x 1 μ; cystidia nullis.

In ligno Pinus rigidae, Houserville, Pa., U. S. A., Nov. 24, 1921, typus in herbario Overholtsii ut No. 8023 conservatus.

Sporophore monomitic, the context of rarely branched, solid or nearly so, rather rarely nodose-septate generative hyphae 2-3 (-4) μ in diam; trama of similar hyphae; gloeoplerous hyphae 5-7 μ in diam; hyphal pegs present; cystidia absent; basidia slender-clavate, 12-17 x 4-5 (-6) μ; spores hyaline, smooth, inamyloid, cylindrical, often somewhat bent, 3.5-5 x 1.5 μ.

Known only from the type on wood of gymnosperms in Pa. The sporophore resembles that of *T. semisupinus* which differs in having a dimitic hyphal construction and ellipsoid to oval spores 2.5-4 x 1.5-3 μ. The upper surface closely resembles that of *Polyporus biformis* Fries which differs in the pore surface usually becoming hydnoid, the pores 1-2 per mm, and the spores 6-8 x 2-2.5 μ.

11b. *Context much thicker, to 30 mm thick*

20. TYROMYCES CAESIUS (Schrad. ex Fries) Murr. Fig. 20

N. Amer. Flora 9:34. 1907. *Polyporus caesius* Schrad. ex Fries, Syst. Myc. 1:360. 1821. *Boletus caesius* Schrad., Spicil. Florae Germ., p. 167. 1794.

Sessile or effused-reflexed, solitary or subimbricate, taste mild; pileus when fresh white or grayish or in part with a bluish tint, sometimes more intensely blue where bruised, convex, dimidiate, soft and watery when fresh, firm when dry, up to 5 x 6 x 1.5 cm, above villous-pubescent or strigose or varying to nearly glabrous, azonate, the margin thin to thick, below fertile to edge; pore surface dull, the pores angular, 3-4 per mm, dissepiments thin, becoming lacerate; tubes rather firm but fragile when dry, up to 7 mm long; context soft and watery when fresh, firm-friable when dry, up to 1 cm thick.

Sporophore monomitic, the context of infrequently branched, thick-walled, nodose-septate generative hyphae 4-8 μ in diam; trama of similar hyphae except 3-5 μ in diam; gloeoplerous hyphae present; hyphal pegs present; cystidia none; basidia clavate, 14-17 x 4-5.5 μ; spores hyaline, smooth, inamyloid, cylindrical, slightly curved to allantoid, 3-5 (-6) x 1-1.5 μ.

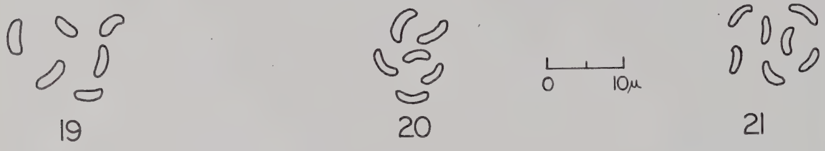


Fig. 19. Spores of *T. lineatus* from type at PAC, Overholts Herb. 8023. Fig. 20. Spores of *T. caesius* from Lowe 10076 at SYRF. Fig. 21. Spores of *T. tephroleucus* from 1315 Fung. Exs. Suec., filed as *Polyporus lacteus* at BPI.

On the wood of both gymnosperms and angiosperms, common and widely distributed; associated with a brown rot, see Hepting (1971). The species is very similar to *T. tephroleucus* and differs principally in its bluish tint, usually most marked on the pore surface. Compare also *P. caesioflavus*, page 71.

Tyromyces caesiosimulans Atk., Ann. Myc. 6:61. 1908 (type at CUP), is *T. caesius* parasitized by *Tremella polyporina* Reid, see Lowe 1974, and Reid 1970, p. 416.

21. TYROMYCES TEPHROLEUCUS (Fries) Donk

Plate I B and Fig. 21

Utrecht Rijksun. Mus. Herb. Meded. 9:150. 1933. *Polyporus tephroleucus* Fries, Syst. Myc. 1:360. 1821. *Polyporus lacteus* Fries of Epicrisis, p. 453. 1836-38 and of Hym. Eur., p. 546. 1874. *Polyporus tephroleucus* var. *scruposus* Lloyd, Mycol. Writ. 6:885. 1919 (BPI).

Sessile or effused-reflexed, solitary, without distinctive odor, taste mild to somewhat acid; pileus convex, dimidiate, soft and watery when fresh, rigid and fragile when dry, up to 4 x 8 x 3.5 cm, above white to grayish, drying pale yellowish brown or grayish, finely tomentose to glabrous, usually with a thin pellicle on drying, azonate, the margin abruptly thin, with a sterile marginal zone below; pore surface drying white to yellowish, glancing, the pores round to angular, about 3-5 per mm, dissepiments thin, dentate to somewhat lacerate; tubes cream or somewhat yellowish, drying rather soft and fragile, up to 10 mm long; context white, when dry usually fibrous and fissile where broken, soft, azonate, up to 3 cm thick.

Sporophore monomitic, the context of rarely branched, thick-walled, nodose-septate generative hyphae 4-6 µ in diam; trama of similar hyphae except some thin-walled; gloeoplerous hyphae present; hyphal pegs present; cystidia none but cystidioles may be present; basidia clavate, 12-17 x 4-5 µ; spores hyaline, smooth, inamyloid, allantoid, 3-5 x 1-1.5 µ.

On the wood of angiosperms or rarely of gymnosperms, common and widely distributed; associated with a white rot. This is extremely similar to *T. lacteus* which differs in usually having a dimitic hyphal construction, in having a disagreeable taste, and in causing a brown rot. Compare also *P. caesioflavus*, p. 71.

A specimen at Kew identified by Fries, and the only one known to me so identified by Fries, has the sporophore construction of *T. albellus* as described in this manual. If the Kew specimen is selected as neotype, another name will have to be selected to apply to the fungus here described as *T. tephroleucus*. *Bjerkandera melina* Karst. would be the earliest basionym (1887) known to me.

Donk (1972, p. 297) tentatively favors the above interpretation of *T. tephroleucus*.

22. TYROMYCES LEUCOMALLUS (Berk. & Curt.) Murr. Fig. 22

N. Amer. Flora 9:36. 1907. *Polyporus leucomallus* Berk. & Curt., Linnean Soc. Jour. Bot. 10:308. 1868 (K; NY). *P. verecundus* Berk. & Curt., same except p. 309 (K; BPI; NY). *Trametes pura* Berk. & Curt., same except p. 320 (K; BPI; FH; NY). *Polyporus immaculatus* Berk. & Curt. *in* Lloyd, Myc. Writ. 4, Apus p. 299. 1915 (K; FH; NY).

Sessile, solitary, taste mild; pileus applanate to convex, dimidiate, drying rather soft and brittle, up to 5 x 8 x 1.8 cm, above white drying more or less yellowish, velvety to somewhat fibrillose or strigose, azonate, the margin thin, incurved; pore surface white to tan, the pores rounded to angular, 6-9 per mm, dissepiments thin, entire;

tubes drying rigid, brittle, up to 6 mm long; context white, soft and fibrous-fragile above, often firmer next the tubes, up to 1.5 cm thick.

Sporophore monomitic, the context of rarely branched, thin- to thick-walled, frequently nodose-septate generative hyphae 4-7 (-9) μ in diam; trama of similar hyphae except 1.5-6 μ in diam; gloeoplerous hyphae present; hyphal pegs present; cystidia none; basidia clavate, 10-12 x 4-6 μ; spores hyaline, smooth, inamyloid, cylindrical and usually bent, 4-5.5 x 1-1.5 μ.

On wood of angiosperms in Cuba, Jamaica, and Ala., infrequent. Similar to *Polyporus nivosus* which differs in having a trimitic hyphal construction, and oblong spores 5.5-7.5 x 2-3 μ. *Trametes pura* is a myriadoporous form. In an herbarium note Bresadola states that *P. verecundus* and *T. pura* differ from *P. immaculatus* but his basis for the distinction is unknown.

23. TYROMYCES LEUCOSPONGIA (Cooke & Harkn.) Bond. & Sing. Fig. 23

Ann. Myc. 39:52. 1941. *Polyporus leucospongia* Cooke and Harkn., Grevillea 11:106. 1883 (K; BPI).

Resupinate or effused-reflexed to sessile, solitary, without distinctive odor or taste; pileus conchate to convex, dimidiate, very soft and spongy, up to 5 x 10 x 3 cm, above white to cream or brownish, villose or drying with a thin pellicle, azonate, the margin obtuse, often inrolled; pore surface white, drying more or less brown, the pores rounded to angular, (2-) 3-4 per mm, dissepiments

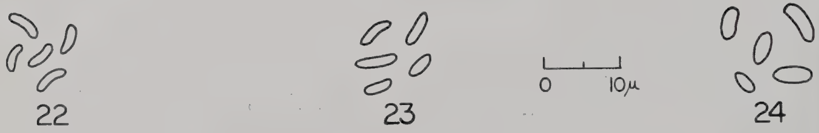


Fig. 22. Spores of *T. leucomallus* from type at K, Wright 104. Fig. 23. Spores of *T. leucospongia* from type at K, Ellis 3731. Fig. 24. Spores of *T. subpendulus* from type, CUP 8252.

thin, fimbriate to incised; tubes drying rigid and brittle, up to 5 mm long; context white to cream, above very soft, below firmer and soft-felty, up to 2.5 cm thick.

Sporophore monomitic, the context of rarely branched, thick-walled, abundantly nodose-septate generative hyphae 4-9 μ in diam; trama of similar hyphae except more slender, 3-6 μ in diam; hyphal pegs present; cystidia none; basidia cylindrical to narrowly clavate, 14-19 x 4-5 (-6) μ; spores hyaline, smooth, inamyloid, cylindrical, straight to somewhat curved, 4-5 (-6) x 1-1.5 μ.

On wood of gymnosperms at high elevations in western parts of the United States, Alaska, and Canada, closely following the retreating snow line; associated with a brown rot, see Boyce (1961) and Hepting (1971).

Surprisingly, in this very soft fungus, the hyphal walls are very thick. The texture of a polypore depends, not on the thickness of the hyphal wall alone, but also on its chemical nature and the compactness of hyphal arrangement. This is the type species for the genus *Spongiporus*.

9b. *Spores 1.5 μ or more wide, oblong to ellipsoid*
  12a. *Sporophore more or less pendent, small*

24. TYROMYCES SUBPENDULUS ATK. Fig. 24

Ann. Myc. 6:61. 1908 (CUP).

Sessile or stipitate and more or less pendent, taste bitter, the stem whitish, glabrous, cylindrical, broadening into the vertex of the pileus, 1-2 mm long; pileus white throughout when fresh, drying cream, ungulate or convex to subapplanate, fibrous-fleshy becoming friable when dry, up to 7 x 10 x 5 mm, above white with sordid pale yellow stains, glabrous, drying subpelliculose, radiately rugose, the margin obtuse, usually entirely surrounding the pore surface and about 1 mm wide; pore surface cream, the pores round to irregular, especially at the margin, 6-8 per mm, dissepiments thin, entire to slightly fimbriate; tubes soft, waxy, up to about 4 mm long; context radiately fibrous-friable, azonate, up to 1 mm thick.

Sporophore monomitic, the context of rarely branched, usually thin-walled, both simple- and nodose-septate generative hyphae 3-6 μ in diam; trama of similar hyphae except 2.5-3 μ in diam; gloeoplerous hyphae up to 12 μ in diam; cystidia none; basidia cylindrical to clavate, 13-18 x 5-7 μ; spores hyaline, smooth, inamyloid, oblong to oblong-ellipsoid, often slightly curved, 4-5 x (1.5-) 2-2.5 μ.

On wood of Tsuga, known only from the type collection from near Ithaca, New York. The sporophore most closely resembles that of T. minusculoides which differs in being much softer when fresh and with much larger pores, 2-3 per mm in fresh specimens.

25. TYROMYCES MINUSCULOIDES (Pil.) Bond. Fig. 25

Polyporaceae Eur., USSR, Caucasia, p. 227. 1953. Leptoporus minusculoides Pil. in Kavina and Pilát, Atlas Champ. Europe 3,1: 193. 1938 (PR).

Usually pendent, sometimes sessile, very weakly attached, taste extremely bitter; stem swelling to form the pileus, the whole more or less turbinate, soft and cottony or rarely firm when fresh, hardening and decidedly shrinking on drying, up to 0.5 x 1 x 0.6 cm, white throughout when fresh, discoloring somewhat yellowish on drying, drying glabrous, the margin rounded, below fertile to edge; pore surface dull, the pores angular, 2-3 (-4) per mm, dissepiments thin, entire to fimbriate; tubes usually extending very nearly the thickness of the sporophore, very fragile when dry; context soft and fragile when dry, not over 2 mm thick.

Sporophore monomitic, the context of rarely branched, very thin-walled and often collapsing, nodose-septate generative hyphae 2-4 (-6) μ in diam; trama of similar hyphae; cystidia none; basidia clavate, 14-19 x 4.5-6 μ; spores hyaline, smooth, inamyloid, minutely apiculate, short-oblong to oblong-ellipsoid, 4-5.5 x 2-2.5 μ.

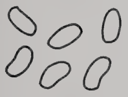
On well-rotted wood of gymnosperms in Quebec, N. Y., Pa., Tenn., Wash., and in Europe. The sporophore is similar to other species of pendent habit. T. subpendulus and

Polyporus gossypinus have a similar hyphal system, but the first has pores 6-8 per mm, and the latter (see p. 72) forms a much larger sporophore and has more slender spores, 1-1.5 μ broad. *P. concrescens* (see p. 72) and *Leptoporus minusculus* Boud., from France, have simple-septate context hyphae and the latter, according to Boudier, has rounded spores 4-6 μ wide. *P. albomollis* Lloyd, from Brazil, is sessile and somewhat similar but differs in having a mild taste, a dimitic hyphal system, and spores 6-7 x 4-5 μ.

26. TYROMYCES CERIFLUUS (Berk. & Curt.) Murr. Fig. 26

N. Amer. Flora 9:33. 1907. *Polyporus cerifluus* Berk. & Curt., Grevillea 1:50. 1872 (K; BPI; FH; NY).

Pendent or effused-reflexed to sessile, solitary or somewhat imbricate, taste bitter or resinously disagreeable; pileus applanate or conchate to convex, dimidiate or with a narrow attachment or attached by a dorsal umbo, rather soft but tough when fresh, up to 2 x 4 x 0.5 cm, above white, drying sordid cream with reddish small spots, indistinctly radiately fibrillose, usually drying with a thin resinous pellicle, azonate, the margin usually rounded, incurved and resinously indurated when dry, poroid to edge; pore surface drying cream to discolored brownish, rough, somewhat glancing, the pores round to more or less angular, distorted on drying, (2-) 3-4 per mm, dissepiments thin, incised and the surface appearing almost hydnoid; tubes darker than the context, drying rigid, fragile, up to 4 mm long; context nearly white, varying from rather soft-fibrous to firm and subcartilaginous, with a thin cartilaginous layer above, up to 2 mm thick.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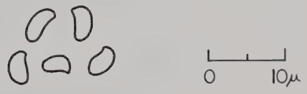

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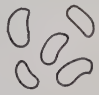
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Fig. 25. Spores of *T. minusculoides* from type, PR 488457. Fig. 26. Spores of *T. cerifluus* from type at K, Ravenel 2926. Fig. 27. Spores of *T. carbonarius* from type at NY, Murrill 64.

Sporophore monomitic, the context of occasionally branched, thin- to thick-walled, frequently nodose-septate generative hyphae 3-4 (-6) μ in diam; trama of similar hyphae except 2-4 μ in diam; hyphal pegs rare; cystidia none; basidia somewhat turbinate, 17-24 x 5-6 μ; spores hyaline, smooth, inamyloid, apiculate, oblong to narrowly ellipsoid, 3.5-5 x 1.5-2.5 μ.

On wood in S. Car., known only from the type. Polystictus revolutus Bres., a European species, is very similar, but seems to differ in having a mild taste.

12b. Sporophore laterally attached, rarely small

27. TYROMYCES CARBONARIUS Murr. Fig. 27

Mycologia 4:94. 1912 (NY; BPI; SYRF).

Sessile, taste slightly resinous; pileus "quite irregular in shape, varying from flabelliform to broadly sessile and laterally elongate, juicy, tough" (Murrill), drying hard, up to 1 x 3 x 0.6 cm, above "white or hygrophanus" (Murrill), when dry resinously matted, fibrillose, faintly radiately marked, faintly zoned, the margin drying resinous, acute; pore surface white, dull, the pores round to angular, 3-4 (-5) per mm, dissepiments rather thick to thin, entire to lacerate; tubes when dry firm but fragile, up to 3 mm long; context cream with resinous streaks, firm and waxy-brittle, up to 5 mm thick.

Sporophore monomitic, the context of very compactly arranged, rarely branched, thin- to thick-walled, occasionally nodose-septate generative hyphae 3-8 μ in diam; trama of similar hyphae except 2.5-4 μ in diam; cystidia none; basidia clavate, 15-20 x 5-6.5 μ; spores hyaline, smooth, inamyloid, oblong and usually slightly bent, 4-5 x (1.5-) 2-2.5 μ.

On charred wood of gymnosperms, known only from the type from Washington; associated rot unknown. The California collections cited by Overholts (1953, p. 296) are of uncertain identity.

28. TYROMYCES FLORIFORMIS (Quél.) Bond. & Sing. Fig. 28

Ann. Myc. 39:51. 1941. Polyporus floriformis Quél. in Bresadola, Fung. Trident. 1:61. 1884 (BPI-isotype). Polyporus subsericeomollis Rom., Sv. Bot. Tidskr. 20:17. 1926 p. pt. sec. Kotlaba and Pouzar in Česká Myk. 18:213 and 217. 1964 (S). ? T. cinchonensis Murr., Mycologia 2:192. 1910 (NY; K).

Usually narrowed to a lateral stemlike base, sometimes imbricate in the form of a rosette and with a central stemlike point of attachment, taste bitter; pileus conchate, often spathulate, subcoriaceous, rigid when dry, up to 4 x 5 x 0.4 cm, above white becoming more or less yellow or blackening, on drying sometimes radially streaked, "appressed silky and minutely radiate-fibrillose" (Overholts), azonate or faintly zonate, the margin thin, usually drying incurved, below fertile to edge; pore surface white, yellowish on drying, the pores round to angular, 4-6 (-8) per mm, dissepiments rather thick and entire, becoming thin and somewhat lacerate; tubes drying corky-brittle, up to 3 mm long; context white, subcorky becoming soft or in part hard and indurated on drying, up to 2 mm thick.

Sporophore monomitic, the context of rarely branched, thin- to rather thick-walled, abundantly nodose-septate generative hyphae 2.5-6 μ in diam; trama of similar hyphae except not more than 4 μ in diam; some gloeoplerous hyphae present; hyphal pegs present; cystidia none; basidia clavate, 12-19 x 5-6 μ; spores hyaline, smooth, inamyloid, oblong-ellipsoid to ellipsoid, 3.5-5 x (1.5-) 2-2.5 μ.

On the wood of gymnosperms or rarely of angiosperms, widely distributed in eastern and western United States and Canada; rot unknown. The sporophore closely resembles that of T. semisupinus which differs in having a dimitic hyphal construction, a mild taste, and spores usually 2.5-4 μ long. T. balsameus also resembles it but differs in being somewhat thicker, in having cystidia, and a dimitic hyphal construction.

29. TYROMYCES GUTTULATUS (Peck) Murr. Fig. 29

N. Amer. Flora 9:31. 1907. Polyporus maculatus Peck, N. Y. State Mus. Ann. Rept. 26:69. 1874, not P. maculatus

Berk. 1851 (NYS; BPI). Polyporus guttulatus Peck, N. Y. State Mus. Ann. Rept. 33:37. 1880. T. substipitatus Murr., Mycologia 4:96. 1912 (NY; BPI; SYRF). Polyporus grantii Lloyd, Myc. Writ. 5:763. 1918 (BPI).

Sessile to substipitate, solitary, taste somewhat disagreeable or resinous; pileus conchate to applanate, dimidiate to spathulate, up to 10 x 22 x 1.5 cm, above white drying discolored yellowish or pinkish, faintly zonate, often with a thin pellicle, usually with rounded depressed spots particularly toward the margin, glabrous, smooth, the margin rather thin, rounded; pore surface drying cream color or darkening somewhat, glancing, the pores subangular, 4-6 per mm, dissepiments rather thin, entire to minutely fimbriate; tubes when dry darker than the context, drying rigid, fragile, up to 1 cm long; context white, fissile, fibrous, up to 6 mm thick.

Sporophore monomitic, the context of rarely to moderately branched, thin- to thick-walled, frequently nodose-septate generative hyphae 4-6 (-9) µ in diam; trama of similar hyphae; gloeoplerous hyphae present; hyphal pegs present; cystidia none; basidia narrowly clavate, 14-24 x 4.5-6 µ; spores hyaline, smooth, inamyloid apiculate, oblong, 4-5 (-6) x 2-2.5 (-3) µ.

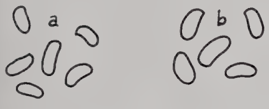
On the wood of gymnosperms or more rarely of angiosperms, infrequent but widely distributed; associated with a brown cubical rot, see Hepting (1971). T. immitis differs in not having rounded depressed spots on the upper surface, and in having spores 1.5-2 µ wide.

Tyromyces tiliophila Murr. (N. Amer. Flora 9:33. 1907) is considered a synonym by Overholts (1953, p. 286) but this is somewhat uncertain as the type, at NY and BPI, has a mild taste and lacks spots on the upper surface.

30. TYROMYCES ALBOGILVUS (Berk. & Curt.) Murr. Fig. 30

N. Amer. Flora 9:36. 1907. Polyporus albogilvus Berk. & Curt., Linnean Soc. Jour. Bot. 10:308. 1868 (K; BPI; FH; NY).

Sessile, solitary, without particular odor or taste; pileus applanate to convex, dimidiate, up to 3 x 3.5 x 0.6 cm, above cream with a yellowish- or reddish-brown thin pellicle, "gilvous when fresh" (Murrill), glabrous, azonate, smooth to radially wrinkled, the margin rounded; pore surface sordid cream to dark cream, the pores angular or somewhat lamellate near the margin, 6-9 per mm, dissepiments thin, entire to fimbriate; tubes more or less concolorous or somewhat translucent, soft-brittle, up to 4 mm long; context cream, soft fibrous-friable, up to 2 mm thick.



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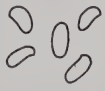

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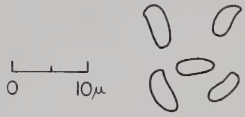

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Fig. 28. Spores (a) of *T. floriformis* from isotype at BPI; spores (b) of *T. cinchonensis* from type at NY, Murrill 500. Fig. 29. Spores of *T. guttulatus* from Lowe 15127 at SYRF. Fig. 30. Spores of *T. albogilvus* from type at K, Wright 415.

Sporophore monomitic, the context of rarely to frequently branched, thin- to thick-walled, nodose-septate generative hyphae 2-8 µ in diam; trama of similar hyphae except not over 4 µ in diam; gloeoplerous hyphae present; cystidia none; basidia clavate, 19-31 x 5-8 µ; spores hyaline, smooth, oblong-ellipsoid, inamyloid, 4-5 x 2-2.5 µ, or cylindric, "5-6 x 2.2-2.5 µ" (Pegler).

On wood of angiosperms in Cuba, known only from the type collection. Other specimens seen and so named do not agree with the type collection. Externally the sporophore resembles that of *Polyporus flavescens* Mont. but internally that differs in having a trimitic hyphal construction and in having spores 7-8 µ long. The Kew type of *T. albogilvus* is annotated by Bresadola, " Ne pas = *P. flavescens*, structura tout fait diverse".

1b. *Hyphal construction dimitic* (see also 1c)
  13a. *Context monomitic; trama with skeletal hyphae*

31. TYROMYCES ALBELLUS (Peck) Bond. & Sing.

Plate I H and Fig. 31

Ann. Myc. 39:52. 1941. Polyporus albellus Peck, N. Y. S. Museum Ann. Rept. 30:45. 1878 (NYS-neotype; BPI; K; SYRF). Not P. albellus Massee, 1899.

Sessile, usually solitary, without particular odor, taste mild, drying light in weight; pileus convex, dimidiate, up to 8 x 8 x 3 cm, above white drying usually whitish to yellowish or grayish, finely tomentose to glabrous, often with a thin pellicle, smooth to wrinkled, azonate, the margin acute, below with a narrow sterile zone or fertile to margin; pore surface white to cream, glancing, the pores round, 4-5 (-6) per mm, dissepiments rather thick to thin, entire; tubes drying rather soft, up to 5 mm long; context white to cream, soft to firm when dry, spongy, azonate, up to 2.5 cm thick.

Sporophore dimitic, the context monomitic, of much branched, thick-walled, nodose-septate generative hyphae 3-5 (-12) μ in diam; trama dimitic, of infrequently branched generative hyphae 2-3.5 μ in diam and of skeletal hyphae 2-4 μ in diam; gloeoplerous hyphae present; hyphal pegs infrequent; cystidia none; basidia clavate, 9-14 x 4-6 μ; spores hyaline, smooth, inamyloid, allantoid, 3-5 x 1-1.5 (-2) μ.

On wood of angiosperms, common and widely distributed; associated with a white rot. The type collection from the Helderberg Mountains near Albany, N. Y., appears to be lost; the neotype was selected from Adirondack collections identified by Peck, and with study notes by L. O. Overholts.

A specimen at Kew named Polyporus tephroleucus by Fries, if accepted as authentic and designated as neotype, will put T. albellus in synonomy with T. tephroleucus, as both have the same characteristics.

Donk (1972, p. 289-293), however, believed P. albellus is a synonym of P. chioneus Fries.

32. TYROMYCES CANADENSIS (Overh.) Lowe, comb. nov.

Plate I C and Fig. 32

Polyporus canadensis Overh., Mycologia 33:97. 1941 (PAC)[1].

Sessile to substipitate, solitary or often imbricate, aromatic when fresh, taste not distinctive; pileus conchate, dimidiate or narrowed at attachment, soft-spongy to watery-tough, drying rigid, up to 5 x 7 x 0.8 cm, above sodden and white to gray or brownish, tomentose to fibrillose, often drying radially striate or strigose and with black dots, the margin thin, sometimes fibrillose, below with sterile border up to 2 mm wide; pore surface white, drying cream to pale brown, somewhat glancing, pores angular, (4-) 5-6 per mm, dissepiments thin, entire to minutely fimbriate; tubes drying darker than context and rigid, very fragile, up to 3 mm long; context white, fissile, soft-fibrous in upper half, much firmer next to the tubes, sometimes with resinous streaks, zonate, up to 5 mm thick.

Sporophore dimitic, the context monomitic, of rarely to often branched, thick-walled, frequently nodose-septate generative hyphae 3-6 μ in diam and often in strands; trama dimitic, of firmly coherent, rarely branched, thin- to thick-walled, rarely nodose-septate and also simple-septate generative hyphae 3-4 μ in diam, and of skeletal hyphae 2.5-5 μ in diam; cystidioles frequent; basidia clavate, 12-19 x 5-6 μ; spores hyaline, smooth, inamyloid, broadly oval to subglobose, 2.5-3 (-3.5) x 2-2.5 μ.

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[1] As this species has not been validated by a Latin description, a validating diagnosis is supplied here:

POLYPORUS CANADENSIS Overholts sp. nov. - Pileo imbricato-sessili, aquoso-lento, siccante rigido et fragili, 3-5 cm longo, 3-7 cm lato, 0.3-0.8 cm crasso, superne albo, tomentoso; contextu duplici, albido, crasso 2-4 mm; poris angulatis, 4-6 pro mm; sporis subglobosis vel late ellipsoideis, laevibus, hyalinis, 2-3 x 1.5-2 μ; cystidiis diametro 4-5 μ; hyphis contextis nodoso-septatis, plerumque in diametro 4-6 μ.

In ligno Piceae prope Ottawa, Ontario, Canada, Aug. 16, 1933, legit J. W. Groves, typus in herbario Overholtsii ut No. 16860 in PAC et isotypus in DAOM ut No. 3593 conservatus.

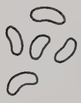
On wood of gymnosperms in Ont. (type), New York, Idaho, Wash., Mont., and Oregon; associated with a white stringy rot. Externally it is somewhat similar to *T. immitis* which differs in having a bitter taste and oblong spores 4-5.5 x 1.5-2 µ; also sometimes similar to *T. fumidiceps* which occurs on wood of angiosperms and has tubes that are usually greenish.

13b. *Context dimitic*
  14a. *Context with skeletal hyphae*
    15a. *Trama monomitic*

33. TYROMYCES HYDROPHILUS (Berk. & Curt.) Lowe, comb. nov.
Fig. 33

Polyporus hydrophilus Berk. & Curt., Linnean Soc. Jour. Bot. 10:306. 1868 (K; BPI; FH).

Sessile, solitary, taste mild; pileus conchate to applanate, dimidiate to subspathulate, up to 4 x 6 x 0.6 cm, above grayish-orange or pale brown, somewhat tomentose, mostly drying matted and wrinkled, zonate and sulcate towards margin, the margin thin, undulate, lobed, below fertile to edge; pore surface tan, the pores angular, irregular and somewhat compressed, 8-10 per mm, dissepiments thin, entire to fimbriate or lacerate; tubes cinnamon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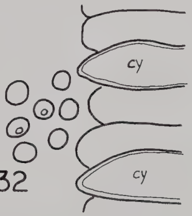

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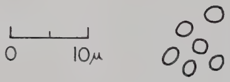

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Fig. 31. Spores of *T. albellus* from neotype at NYS. Fig. 32. Spores and cystidioles (cy) of *T. canadensis* from isotype at SYRF from Overholts Herb. 16860. Fig. 33. Spores of *T. hydrophilus* from isotype at BPI, Lloyd Herb. 49611.

to translucent reddish, papery to brittle, up to 3 mm long; context pale brown, rather soft-punky except for a hard gelatinized line running through the middle that may be enlarged to occupy the lower context and make it a strongly zonate zone, up to 3 mm thick.

Sporophore dimitic, all hyphae more or less agglutinated, in the context above the line monomitic, of thin- to somewhat thick-walled, nodose-septate generative hyphae 2-6 μ in diam, below the line dimitic, of often branched, thin-walled, nodose-septate generative hyphae 1.5-4.5 μ in diam and skeletal hyphae 3-6 μ in diam; trama monomitic, of thin-walled, nodose-septate generative hyphae 1-2.5 μ in diam; gloeoplerous hyphae rather rare; hyphal pegs occasional; cystidia none; spores hyaline, smooth, inamyloid, oval to subglobose, 2-3 x 1.5-2 μ.

On wood in Cuba and British Honduras; type of rot unknown.

15b. Trama dimitic, with skeletal hyphae
  16a. Cystidia present

34. TYROMYCES SEMISUPINIFORMIS Murr. Fig. 34

N. Y. Bot. Gard. Bull. 8:148. 1912 (NY; BPI; SYRF).

Effused-reflexed, imbricate, taste mild; pileus conchate, dimidiate or laterally fused, rigid, brittle, up to 1 x 2 x 0.2 cm, above cream to somewhat yellowish, glabrous, azonate, the margin thin, acute, below with a sterile margin up to 1 mm wide; pore surface cream with a pinkish tinge, dull, the pores angular, about 9-10 per mm, dissepiments rather thin, entire; tubes rigid, up to 0.5 mm long; context cream, somewhat soft, somewhat radially fibrous, up to 1.5 mm thick.

Sporophore dimitic, the context dimitic, of rarely branched, thin-walled, nodose-septate generative hyphae mostly 3-5 μ in diam and of rarely branched, thick-walled skeletal hyphae 3-6 μ in diam; trama of similar hyphae; cystidia rare to abundant, more common on the outer half of the tubes, heavily incrusted, clavate, about 5-9 μ in diam, imbedded or projecting up to 20 μ; basidia clavate, 10-14 x 4-5 μ; spores hyaline, smooth, inamyloid, oval to subglobose, 2.5-3.5 x 2-2.5 μ.

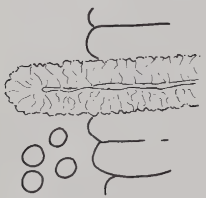
Known only from the type from Mexico; kind of rot unknown. Compare also Polyporus canaliculatus, p. 72.

35. TYROMYCES BOREALIS (Fries) Imaz. Fig. 35

Tokyo Sci. Mus. Bull. 6:84. 1943. *Polyporus borealis* Fries, Syst. Myc. 1:366. 1821. *Polyporus pacificus* Kauffm., Mich. Acad. Sci., Arts, Lett. Papers 11:178. 1930 (MICH).

Sessile or narrowed at the base and substipitate, usually more or less imbricate, taste mild; pileus white throughout but drying yellowish, convex, spathulate to dimidiate or umbilicate, watery-fleshy drying rigid, brittle and light in weight, up to 15 x 15 x 4 cm, above hispid to tomentose, drying rough, the margin thin, acute, below fertile to edge; pore surface smooth to rough when dry, the pores angular to daedaloid, 1-4 mostly 2-3 per mm, dissepiments thin, dentate to incised; tubes drying rigid and brittle, up to 15 mm long; context usually duplex when dry, firm next the tubes, coarsely fibrous above, somewhat zonate when dry, up to 2 cm thick.

Sporophore dimitic, the context dimitic, of mostly rarely branched, thin- to occasionally thick-walled, frequently nodose-septate generative hyphae 4-8 μ in diam, and of skeletal hyphae 4-6 μ in diam; trama of similar hyphae; gloeoplerous hyphae present; cystidia often with coarse apical incrustations, fusoid to ventricose, pointed, imbedded or exserted, 24-38 x 7-13 μ; basidia cylindrical,



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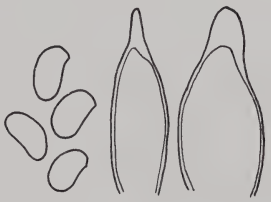

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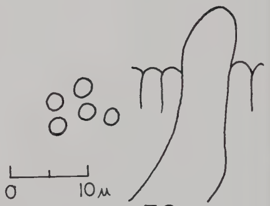

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Fig. 34. Spores and cystidium of *T. semisupiniformis* from type at NY, Murrill 53. Fig. 35. Spores and cystidia of *T. borealis* from type of *Polyporus pacificus* at MICH. Fig. 36. Spores and cystidium of *Polyporus abieticola* from type at PAC, Overholts Herb. 21571.

24-36 x 5-8 μ; spores hyaline, smooth, inamyloid, ellipsoid to ellipsoid-oval, 5.5-7 x 4-5 μ.

On wood of gymnosperms across northern United States and southward in the Rockies to Arizona and New Mexico, and in southern Canada; associated with a fine cuboidal heartwood rot, see Boyce (1961), and Hepting (1971). This fungus is the type species for the genus Climacocystis Kotl. & Pouz. (Česká Myk. 12:95. 1958).

Fidalgo (1958) has intensively investigated this species, which he considers monomitic.

36. TYROMYCES ILLUDENS (Overh. & Lowe) Lowe, comb. nov.
Fig. 36 and 36A

Poria illudens Overh. & Lowe, Mycologia 38:207. 1946.
Polyporus abieticola Overholts, Mycologia 33:93. 1941 (nom. inval.)

Resupinate to effused-reflexed, taste disagreeable; pileus convex, laterally elongated, coriaceous, up to 2 x 7 x 1 cm, above deep cream to brownish, more or less matted, rather smooth, the margin obtuse, below with a sterile zone to 0.5 mm wide; pore surface rather dark cream, dull, the pores rounded, 4-5 per mm, dissepiments rather thick to thin, entire; tubes drying firm, somewhat brittle, up to 4 mm long; context cream, rather soft and fibrous, up to 10 mm thick.

Sporophore dimitic, the context dimitic, of rarely branched, thin-walled, infrequently nodose-septate generative hyphae 2-4 (-5) μ in diam and of skeletal hyphae 2.5-5 μ in diam; trama of similar hyphae; cystidia imbedded or exserted to 15 μ, thin-walled, up to 50 μ long and 14 μ in diam; basidia 2- or 4-sterigmate, clavate, 11-14 x 4-6 μ; spores hyaline, smooth, amyloid, narrowly oval to subglobose, 2.5-3 x 2-2.5 μ.

On wood of gymnosperms in Quebec, Maine, Vermont, and New York; recorded from New Zealand; associated with a white rot. Externally this resembles pale, narrowly reflexed Polyporus nidulans Fries, but the tissue of that turns red or purple in KOH. T. canadensis is more nearly white and has inamyloid spores. Forms of Trametes squalens with brownish upper surface differ in having binding hyphae and spores 7-9 x 2.5-3 µ.

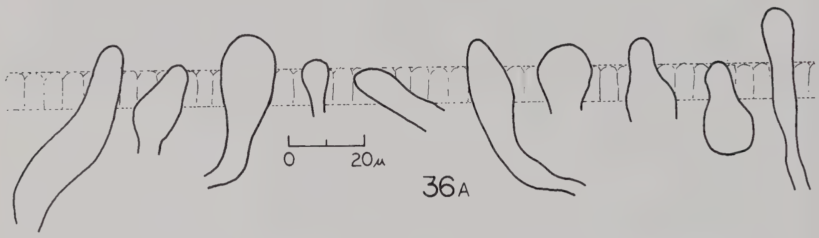


Fig. 36A. Variations in forms of cystidia from type of *P. abieticola*.

The name *Polyporus abieticola* is invalid because a Latin diagnosis was not published with the original description.

16b. *Cystidia absent*
  17a. *Spores ellipsoid to globose*
    18a. *Context not over 0.5 cm thick, firm, at least below*

37. TYROMYCES SEMISUPINUS (Berk. & Curt.) Murr. Fig. 37

N. Amer. Flora 9:34. 1907. *Polyporus semisupinus* Berk. & Curt., Grevillea 1:50. 1872 (K). *Polyporus pachycheiles* Ell. & Everh., Acad. Nat. Sci. Philadelphia Proc. for 1894:322. 1894 (NY; BPI). *Polyporus pallescens* Karst. in Romell, Ark. f. Bot. 11(3):19. 1912 (S). *Coriolus genistae* Bourd. & Galz., Soc. Myc. France Bull. 41:145. 1925 p. pt.

Resupinate to effused-reflexed or sessile, often imbricate and in the form of a rosette, without distinctive odor or taste; pileus conchate, often narrowed at the base and appearing substipitate, very tough, drying rigid and somewhat coriaceous, up to 2 x 2.5 x 0.4 cm, above whitish to yellowish, often with radial streaks which appear more or less resinous or cartilaginous when dry, glabrous, sometimes with short sterile proliferations, faintly zonate, the margin thin, acute, often resinous and translucent when dry, below fertile to edge; pore surface whitish to yellowish or yellowish-brown, glancing, the pores angular,(4-) 6-8 per mm, dissepiments thin, entire; tubes drying more or less translucent, waxy-tough, up to 3 mm long; context white to pallid, often with resinous streaks, soft-corky to firm, up to 1 mm thick.

Sporophore dimitic, the context dimitic, of rarely branched, thin-walled, rarely to frequently nodose-septate generative hyphae 2.5-5 μ in diam and of thin- to thick-walled, rarely simple-septate skeletal hyphae 2.5-5 μ in diam; trama of similar hyphae; hyphal pegs present; cystidioles few, hyphoid; basidia clavate, 12-17 x 5-6 μ; spores hyaline, smooth, inamyloid, ellipsoid to narrowly oval, 2.5-4 x 1.5-2.5 (-3) μ.

On the wood of angiosperms or rarely of gymnosperms in eastern Canada and the U. S., and in Europe; associated with a white rot.

This fungus most resembles *T. floriformis* which differs in having a bitter taste, in typically growing on a gymnosperm substrate, and with frequent cross walls in the context hyphae. *T. balsameus* differs in having cystidia and occurring on gymnosperm substrata.

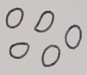
This is Lloyd's concept of *Polyporus epileucus* Fries (Myc. Writ. 4, Apus, p. 309. 1915).

18b. *Context up to 2 cm thick, drying soft*

38. TYROMYCES TRICHROUS (Berk. & Curt.) Lowe, comb. nov.
Fig. 38

Polyporus trichrous Berkeley & Curtis, Ann. Mag. Nat. Hist. 2, 12:434. 1853 (BPI-isotype). *Polyporus sublutescens* Ellis & Everhart in Langlois, Cat. Pl. Basse-La., p. 33. 1887 n. nudem (BPI-isotype). *Polyporus pseudosulphureus* W. H. Long, N. Mex. Chapt. Phi Kappa Phi 1:1. 1917 (BFDL; BPI; K; SYRF). *Polyporus angolensis* Lloyd, Myc. Writ. 6:997. 1920 (BPI).

Laterally stipitate to more or less sessile, solitary, mild in taste, drying very light in weight; pileus convex to applanate, flabelliform to dimidiate, up to 15 x 20 x 3 cm (Overholts as *P. amygdalinus*), above drying medium brownish, densely tomentose-velutinous to glabrous, faintly and distantly zonate, the margin acute; pore surface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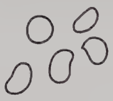
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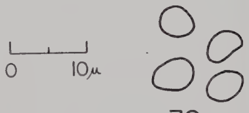

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Fig. 37. Spores of T. semisupinus from type at K, Sprague 5860. Fig. 38. Spores of T. trichrous from Lowe 4243 at SYRF. Fig. 39. Spores of T. graminicola from type at NY, Britton and Brown 834.

dark cream, glancing, the pores angular, about 3-4 per mm, dissepiments thin, fimbriate; tubes rather rigid, up to 5 mm long; context soft-felty above, much firmer next the tubes, up to 2 cm thick, according to Overholts "lemon-yellow in KOH" - this not observed.

Sporophore dimitic, the context dimitic, of rarely to much branched, thin-walled, often nodose-septate generative hyphae 2-7 μ in diam, often fragmenting on drying, and of usually rather thin-walled, rarely branched skeletal hyphae 3.5-6 μ in diam whose walls dissolve in part in KOH; trama of similar hyphae; gloeoplerous hyphae up to 9 μ in diam; cystidia none; basidia clavate, 15-25 x 5-8 μ; spores hyaline, smooth, inamyloid, apiculate, oval or one side often plane, 3-5 x 3-3.5 μ.

On wood of angiosperms in S. Carolina, Florida, Alabama, and Africa; associated with a brown piped rot. This is the concept of Polyporus amygdalinus of Lloyd, Murrill (as Trametes), and of Overholts. The type of T. amygdalinus, however, has bovistoid binding hyphae and cylindric spores 6.5-8 x 2.5-3.5 μ. Polyporus sulphureus Bull. ex Fries and P. persicinus Berk. & Curt. resemble this externally but both have simple-septate hyphae and larger spores, 5-8 x 3.5-5 μ. The species has been treated in detail by Lowe and Pegler in Mycologia 65:208-211. 1973 (as P. pseudosulphureus).

39. TYROMYCES GRAMINICOLA Murr. Fig. 39

Tropical Polypores, p. 21. 1915 (NY; BPI; SYRF). Polyporus propinquus Lloyd, Myc. Writ. 7:1109. 1922 (BPI;

K). Scutiger tisdalei Murr., Lloydia 6:227. 1943 (FLAS).

Sessile or laterally to centrally stipitate, solitary or "forming a large oblong cluster about 30 cm long, 15 cm broad and 10 cm high" (Murrill), "odor pungent-fungoid, not unpleasant, slightly chlorine-like, older specimens becoming malodorous like decaying vegetables or garbage" (Gilbertson and Lowe), taste mild, drying very light in weight; pileus applanate to convex, flabelliform to more or less circular, up to 20 cm across, to 2 cm thick, drying very light and brittle, above white drying buff and with darker spots, finely tomentose to glabrous, smooth, with a thin crust, azonate, the margin obtuse to acute, below with a sterile zone up to 1.5 mm wide; pore surface concolorous with upper surface, the pores rounded to angular, 2-4 per mm, dissepiments becoming thin and lacerate; tubes drying rigid and fragile, up to 3 mm long; context fissile, crisp and breaking cleanly, drying soft but brittle and darkening slightly, up to 2 cm thick.

Sporophore dimitic, the context dimitic, of thin-walled, readily collapsed, both simple- and nodose-septate generative hyphae with occasional double or multiple clamps, 3-14 µ in diam, and skeletal hyphae 2.5-7 µ in diam; trama of similar hyphae except more slender and clamps less frequent; gloeoplerous hyphae present; hyphal pegs none; cystidia none; basidia clavate, 16-24 x 5-8 µ; spores hyaline, smooth, weakly to strongly amyloid, ellipsoid to oval, 4.5-5.5 x (2.5-) 3-4 µ.

Attached to various angiosperms in Bermuda, Florida, Texas, Arizona, Brazil, and Africa. This species has been treated in detail by Gilbertson and Lowe in Mycologia 62: 699-706. 1970. Its generic position is uncertain, as evidenced by Murrill's disposition, in various herbaria, to no less than 5 different genera. It is the type species for the genus Amylosporus Ryv. (Ryvarden 1973, p. 1).

17b. Spores cylindric to oblong-ellipsoid

40. TYROMYCES DURACINUS (Pat.) Murr.

Plate I D and Fig. 40

N. Amer. Flora 9:37. 1907. Leptoporus duracinus Pat., Soc. Myc. France Bull. 18:174. 1902 (FH; BPI; NY; S).

Coriolus ochrotinctellus Murr., N. Amer. Flora 9:22. 1907 (NY; BPI; K).

Laterally attached by a narrowed base, solitary, taste mild; pileus conchate to convex, up to 7 x 10 x 0.4 cm (Overholts), above cream with reddish zones to pale brown, glabrous, appearing almost pelliculose, distantly zonate, the margin darker, incurved, thin; pore surface cream-colored, glancing, the pores rounded to angular, 6-8 per mm, dissepiments thick to thin, entire; tubes drying waxy-fragile, up to 2 mm long; context cream, rather soft and spongy-corky, up to 2 mm thick.

Sporophore dimitic, the context dimitic, of rarely branched, thin- to rarely thick-walled, nodose-septate generative hyphae 2.5-6 µ in diam, and of very similar hyphae without cross walls 3-6 µ in diam somewhat doubtfully considered skeletal hyphae; trama of similar hyphae except more commonly thick-walled; hyphal pegs present; cystidia none; basidia clavate, 10-14 x 4-5(-6) µ; spores hyaline, smooth, inamyloid, cylindrical and slightly bent, 4-5 x 1.5-2 µ ("4x1 µ", Patouillard).

On wood of angiosperms in Guadeloupe, Fla., and Miss.; type of rot unknown.

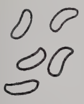
41. TYROMYCES VERSICUTIS (Berk. & Curt.) Murr. Fig. 41

N. Amer. Flora 9:33. 1907. Polyporus versicutis Berk. & Curt., Linn. Soc. Jour. Bot. 10:308. 1868 (K; BPI; FH; NY). P. versipellis Auct.

Sessile or effused-reflexed, solitary, taste mild; pileus convex, dimidiate, "fleshy-tough" (Murrill) drying rigid, up to 3 x 5 x 0.6 cm, above cream to resinous red, more or less reddish-pelliculose, usually smooth, glabrous, azonate, the margin obtuse; pore surface cream or darker to brown-black, the pores round, about 8-10 per mm, dissepiments becoming rather thin, entire; tubes reddish resinous, firm, waxy-brittle when dry, up to 2 mm long; context pale pinkish brown, radially fibrous, somewhat firm, up to 4 mm thick.

Sporophore dimitic, the context dimitic, of thin-walled, nodose-septate generative hyphae 2-3 μ in diam, and of thick-walled skeletal hyphae (2-) 3-5 (-6) μ in diam; trama of similar tissue, with thick-walled skeletal hyphae 2-3.5 μ in diam; hymenial characters lacking in all type material, in other Kew specimens so identified spores "hyaline, inamyloid", cylindric, "4.5-5.5 x 1.5-2.0 μ" (Pegler).

On wood in Cuba, Puerto Rico, Trinidad, Nicaragua, Panama, and in South America. The spore measurements were obtained from a Trinidad collection at Kew, Wakefield 319. D. Reid at Kew has reexamined No. 319 and doubts that it is the same as the type of *P. versicutis*.



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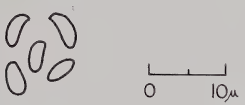

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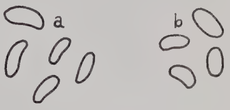

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Fig. 40. Spores of *T. duracinus* from type at FH, Patouillard Herb sheet 2575. Fig. 41. Spores of *T. versicutis* from Wakefield 319 at K., drawing by D. Pegler. Fig. 42. Spores (a) of *T. immitis* from isotype at BPI; spores (b) of *Polyporus stipticus* from 1316 Fungi Exs. Suec. at BPI.

The type selected is Wright 137.

42. TYROMYCES IMMITIS (Peck) Bond. Fig. 42

Polyporaceae Eur. USSR, Caucasia, p. 228. 1953. *Polyporus immitis* Peck, N. Y. S. Mus. Ann. Rept. 35:135. 1884 (NYS; BPI; FH; PAC). *P. epileucus* var. *candidus* Peck, N. Y. S. Mus. Ann. Rept. 38:91. 1885 (NYS; BPI).

Sessile, often imbricate, taste bitter; pileus convex, dimidiate, tender and watery becoming rigid when dry, up to 8 x 15 x 2.5 cm, above dull white, drying pelliculose or rarely powdery, usually rough and scabrous and often with black spots, the margin rounded, below poroid to edge; pore surface drying cream to yellowish, glancing, the pores angular, 4-6 per mm, dissepiments thin, entire; tubes drying rigid, fragile, up to 10 mm long; context firm, radially fibrous, up to 2 cm thick.

Sporophore dimitic, the context dimitic, of rarely branched, rather thin- to thick-walled, frequently nodose-septate generative hyphae 4-5 (-6) μ in diam and of rather rare skeletal hyphae 4-7 μ in diam; trama dimitic, of generative hyphae 2.5-4 μ in diam and skeletal hyphae 3-5 μ in diam; hyphal pegs present; basidia clavate, 12-18 x 5-6 μ; cystidia none; spores hyaline, smooth, inamyloid, cylindrical, 4-5.5 x 1.5-2 μ.

On wood of angiosperms or more rarely of gymnosperms, common and widely distributed; associated with a brown rot. The concept is very similar to that of *T. guttulatus* which appears to differ in not having so distinct a bitter taste, in usually drying with depressed spots above, and in having spores 2-3 μ wide. The concepts of *Polyporus albidus* Schaeff. ex Fries and *P. stipticus* (Pers.) Fries of European authors is often the same as for *T. immitis*. *T. lacteus* differs in having narrower allantoid spores.

14b. *Context with binding hyphae*
  19a. *Trama monomitic* (see also 53. *P. nivosus* and 55. *P. palustris*)

43. TYROMYCES LACTEUS (Fries) Murr. Fig. 43

N. Amer. Flora 9:36. 1907. *Polyporus lacteus* Fries, Syst. Myc. 1:359. 1821 (nec alibi).

Sessile, usually solitary, sometimes with a sweet odor when fresh, taste instantly or slowly disagreeable or bitter, drying light in weight; pileus convex to ungulate, dimidiate or laterally elongated, watery-fleshy, up to 5 x 9 x 5 cm, above white or grayish to pale grayish brown, minutely velvety or often somewhat sodden, drying with a thin often discontinuous pellicle, azonate, the margin obtuse, below fertile to edge; pore surface white, glancing, the pores usually angular and regular, 4-5 per mm, sometimes irregular and 2-5 per mm, dissepiments thin, entire or more often fimbriate, rarely incised to lacerate; tubes watery-tough drying firm-fragile, up to 2 cm long, rarely longer than the thickness of the context; context drying soft to firm, radially fibrous, azonate to faintly zonate, up to 4.5 cm thick.

Sporophore dimitic, the context dimitic, of rarely to often branched, rather thin- to thick-walled, nodose-septate generative hyphae 4-7 μ in diam, and of apparently absent to much more often scattered to abundant binding hyphae 2-4 μ in diam, best developed just above the tubes; trama monomitic, of rarely branched, usually thick-walled nodose-septate generative hyphae 3-5 μ in diam; gloeoplerous hyphae 5-17 μ in diam; hyphal pegs present; cystidia none; basidia clavate, 12-21 x 4-5(-6) μ; spores hyaline, smooth, inamyloid, allantoid, 4-5 (-6) x 1-1.5 μ.

On the wood of angiosperms or of gymnosperms from Ontario to North Carolina westward to Montana and Arizona, in Europe and in Japan; associated with a brown rot. This species is discussed in detail by Lowe and Lombard in Mycologia 65:725-732. 1973.

Donk (1972, p. 297) tentatively prefers the interpretation of T. lacteus given above.

44. TYROMYCES UNDOSUS (Peck) Murr. Fig. 44

N. Amer. Flora 9:34. 1907. Polyporus undosus Peck, N. Y. State Mus. Ann. Rept. 34:42. 1881 (NYS; BPI; FH; NY; SYRF). T. pseudotsugae Murr., Mycologia 4:95. 1912 (NY; BPI).

Effused-reflexed or resupinate, often laterally confluent, without distinctive odor or taste; reflexed pileus convex, laterally elongated or dimidiate to elongated forward and somewhat spathulate, subcoriaceous to fibrous-fleshy, drying rigid, up to 2.5 x 11 x 1 cm, above whitish to yellowish or brownish or reddish, slightly spongy-tomentose or in part subpelliculose, obscurely sulcate and zonate, the margin acute to obtuse, characteristically markedly undulate, below fertile to edge; pore surface cream to brownish, dull, the pores angular, 1-3 per mm, dissepiments thin, entire to dentate or incised; tubes white to yellowish, drying rigid, fragile, up to 10 mm long; context white to cream, sometimes with a hard cartilaginous line just above the tubes, otherwise soft and cottony to fibrous or fragile, up to 1.5 mm thick.

Sporophore dimitic, the context dimitic, of rarely to frequently branched, thick-walled, frequently nodose-septate generative hyphae 4-8 µ in diam, and of poorly developed binding hyphae 2.5-4 µ in diam; trama monomitic, of similar generative hyphae; hyphal pegs present; cystidia none; basidia clavate, 14-19 x 4-5 µ; spores hyaline, smooth, inamyloid, allantoid, 4-5.5 (-6) x 1-1.5 (-2) µ.

On wood of gymnosperms or rarely of angiosperms, widely distributed in the United States and Canada, and in Europe; associated with a brown checked rot, see Brotzman and Gilbertson in Mycopath. and Mycol. Appl. 33:33-42. 1967.

45. TYROMYCES LOWEI (Pil.) Bond. Fig. 45

Polyporaceae Eur. USSR and Caucasia, p. 227. 1953. *Leptoporus lowei* Pil. *in* Kavina and Pilát, Atl. Champ. Europe 3,1:205. 1938 *pro* parte (PR; BPI; SYRF).

Resupinate to effused-reflexed or sessile, taste slowly disagreeable; pileus conchate to convex, up to 1.5 x 6 x 0.5 cm, above whitish with reddish radial streaks, not much changing on bruising when fresh or on drying, more or less glabrous, sometimes faintly zonate, the margin acute, thin, often reddish resinous when dry; pore surface cream, drying dull and yellowish or reddish brown, the pores angular, (2-) 3-4 per mm, edges thin,

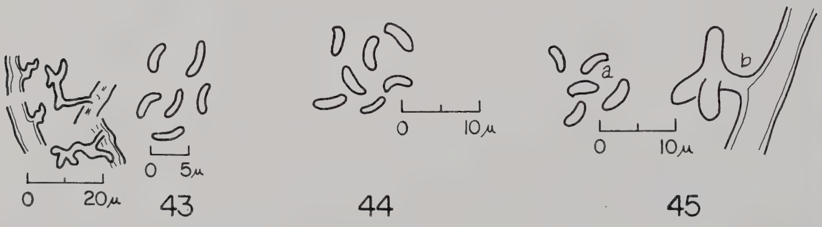


Fig. 43. Binding hyphae and spores of *T. lacteus* from Lowe 11783 at SYRF. Fig. 44. Spores of *T. undosus* from isotype at SYRF. Fig. 45. Spores (a) and binding hyphae (b) of *T. lowei* from type at Prague, PR 487991.

entire to lacerate; tubes white, drying yellowish, rigid, fragile, up to 4 mm long; context white, fleshy-fibrous and drying soft and friable, or sometimes cartilaginous above, up to 1 mm thick.

Sporophore dimitic, the context dimitic, of infrequently branched, thin- to thick-walled, rather rarely nodose-septate generative hyphae 2-4 (-5) μ in diam and of binding hyphae poorly developed as short side branches; trama monomitic, of similar generative hyphae; cystidia none; basidia clavate, 14-19 x 5-6 (-7) μ; spores hyaline, smooth, inamyloid, cylindrical and more or less curved, 4-5 (-6) x 1.5-2 μ.

On the wood of gymnosperms in N.Y.; associated with a brown checked rot. Monomitic and mild-tasting species of like appearance are *T. fragilis* and *T. lineatus*. *T. leucomallellus* is extremely similar but differs in having gloeocystidia. *T. perdelicatus* remains more nearly white, and has spores 1-1.5 μ wide.

The Isle Royale, Michigan, specimen cited in the original description is *T. leucomallellus*.

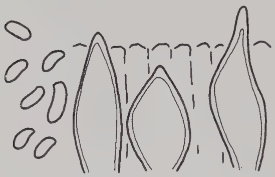
19b. *Trama with binding hyphae*

46. TYROMYCES BALSAMEUS (Peck) Murr. Fig. 46

Northern Polypores, p. 13. 1914. *Polyporus balsameus* Peck, N. Y. State Mus. Ann. Rept. 30:46. 1878 (NYS; BPI; FH). *P. crispellus* Peck, N. Y. S. Mus. Ann. Rept. 38:91. 1885 (NYS; BPI; FH). *Tyromyces cutifractus* Murr., Mycologia 4:94. 1912 (NY; BPI; FH).

Sessile or effused-reflexed, often imbricate, taste mild or slightly resinous; pileus conchate to convex, flabelliform to dimidiate, subcoriaceous to fleshy-tough, drying rather rigid, up to 3 x 5 x 0.5 cm, above cream to brownish, subglabrous to slightly and unequally appressed villose-tomentose, more or less zonate, the margin thin; pore surface white, drying gray or yellowish, the pores subcircular to angular, glistening, 3-6 per mm, dissepiments thick and entire to thin and fimbriate; tubes drying rigid, brittle, up to 4 mm long; context white, rather soft, fibrous, up to 2 mm thick.

Sporophore dimitic, the context dimitic, of rarely to frequently branched, thin- to thick-walled, rarely to frequently nodose-septate generative hyphae 4-7 μ in diam, and of rather rare binding hyphae 1.5-2.5 μ in diam; trama dimitic, of similar hyphae except mostly 3-5 μ in diam and binding hyphae very poorly developed; hyphal pegs present; cystidia abundant to rare, sometimes incrusted at the apex, fusoid, often immersed, 12-40 x 4-9 μ; basidia clavate, 19-24 x 4.5-6 μ; spores hyaline, smooth, inamyloid, oblong, often slightly bent, 4-6 x 2-3 μ.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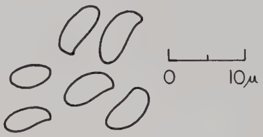

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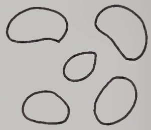
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Fig. 46. Spores and cystidia of T. balsameus from type at NYS. Fig. 47. Spores of T. amygdalinus from type at K, drawing by D. Pegler of Ravenel 1153. Fig. 48. Spores of T. semistipitatus from type at BPI, Lloyd Herb. 56366.

On the wood of gymnosperms or rarely of angiosperms in northern United States and southward in the Rockies to Arizona and New Mexico, and in southern Canada; associated with a brown cubical rot, see Boyce (1961) and Hepting (1971). T. cutifractus and P. crispellus are forms with rare cystidia.

This species is often treated in European manuals as T. kymatodes (Rostk.) Donk but that, according to Kotlaba and Pouzar (Česká Myk. 22:128. 1968), is Polyporus amorphus Fries sense of Donk (1933, p. 154).

47. TYROMYCES AMYGDALINUS (Berk. & Rav.) Teng
Plate I G and Fig. 47

True Fungi of China, p. 520. 1964. Polyporus amygdalinus Berk. & Rav. in Berk. & Curt., Ann. Mag. Nat. Hist. 2(12):432. 1853, again in Grevillea 1:49. 1872 (K; NY).

Sessile, solitary, when fresh odor "strong, like that of vanilla or almonds" (B. & R.); pileus applanate, subspathulate, up to 7 x 5 x 0.5 cm, above "dingy yellow with irregular darker patches", drying dark fuscous brown except for some yellowish radiating streaks, glabrous to somewhat strigose especially toward the base, azonate, the margin undulate, below fertile to edge; pore surface pale brown, the pores irregularly angular, (2-) 3-4 per mm, dissepiments entire; tubes drying very brittle, up to 2 mm long; context very pale yellowish, firm-corky, slowly darkening in KOH, up to 5 mm thick.

Sporophore dimitic, the context dimitic, of rather frequently branched, thin-walled, nodose-septate generative hyphae 3-5 μ in diam or some swollen to 14 μ, and of abundant, bovistoid, mostly thick-walled binding hyphae up to 12 μ in diam; trama of similar hyphae except 2-9 μ in diam; gloeoplerous hyphae present; hymenium lacking; spores "hyaline", smooth, "inamyloid", oblong to oblong-ellipsoid, "6.5-8 x 2.5-3.7 μ" (Pegler).

On oak (Quercus), known only from the type collection, Ravenel 1153, from S. Car. This species has been confused with P. pseudosulphureus (= T. trichrous), as discussed by Lowe and Pegler in Mycologia 65:208-211. 1973.

48. TYROMYCES SEMISTIPITATUS (Lloyd) Lowe, comb. nov.

Fig. 48

Polyporus semistipitatus Lloyd, Mycol. Writ. 7:1271. 1924 (BPI; K).

Sessile to substipitate, taste mild; pileus "pure white," drying cream color throughout, conchate, dimidiate or more or less turbinate when growing on top of substratum, up to 4 x 5 x 0.3 cm, above minutely velvety, azonate, the margin thin, acute, below with a sterile zone up to 2 mm wide; pore surface dark cream, somewhat glancing, the pores angular, about 6 per mm, dissepiments becoming thin, edge entire; tubes drying soft-corky, up to 1 mm long; context duplex, upper half soft-spongy, lower half firm, up to 2 mm thick.

Sporophore dimitic, the context dimitic, of rarely branched, thin-walled, nodose-septate generative hyphae

2-5 μ in diam, and of binding hyphae 1-4 μ in diam; trama of similar hyphae; cystidia none; basidia clavate, 14-17 x 5-7 μ; spores hyaline, smooth, inamyloid, oblong with rounded ends to oval, 5-7 x 3.5-5 μ.

On wood, known only from the type from Kansas; type of rot unknown. The sporophore resembles that of *T. spumeus* and var. *malicola* which have a monomitic hyphal system.

EXCLUDED SPECIES

1c. *Hyphal construction trimitic*

Species with trimitic hyphal construction are excluded from the genus *Tyromyces* as defined in this manual. Most of the following species, briefly described, have been placed in the genus *Tyromyces* or in *Spongipellis* by some author, and can readily be mistaken for a species of *Tyromyces*.

20a. *Context dimitic, with binding hyphae; trama with skeletals*

49. POLYPORUS OBDUCTUS Berk. Fig. 49

Tyromyces obductus (Berk.) Murr.

Sessile, "6 x 12 x 0.3 cm" (Murrill); pileus "expanding from a wedge-shaped base" (Murrill), above pale reddish translucent, glabrous; pore surface cream color, the pores 5-6 per mm; tubes to 2 mm long; context white, to 4 mm thick.

Sporophore trimitic, the context dimitic, of nodose-septate generative hyphae 3-6 μ in diam, and of binding hyphae 4-9 μ in diam; trama dimitic, of generative and skeletal hyphae 2-3 μ in diam; spores presumably hyaline, smooth, oblong, somewhat bent, "4.5-6 x 1.7-2 (-2.5) μ" (Aoshima).

Known only from the type collection from below Latitude 54° in North America. Type material is at K, BPI (with notes by Aoshima), FH, and NY.

20b. *Context trimitic*
  21a. *Trama monomitic*

50. TYROMYCES PALMARUM Murr. Fig. 50

Sessile, without distinctive odor or taste; pileus convex, up to 10 x 15 x 1 cm, above cream color, glabrous; pores 3-4 per mm; tubes up to 4 mm long; context white, rather soft and somewhat fissile, up to 6 mm thick.

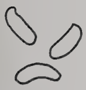
Sporophore trimitic, the context trimitic, of generative hyphae 2.5-4 μ in diam, of skeletals 2.5-5 μ in diam, and of binding hyphae 1.5-3 μ in diam; trama monomitic; cystidia none; spores hyaline, smooth, oblong-ellipsoid, "6-8 x 2.5-3.5 μ" (Setliff), or "6.8-8.8 x 2.8-3.8 μ, averaging 7.7 x 3.3 μ" (Weir).

On palm in Florida, known only from the type material at NY and BPI.

51. POLYPORUS SEMIPILEATUS Peck Plate I E and Fig. 51

Tyromyces semipileatus (Peck) Murr.

Resupinate to effused-reflexed, without distinctive odor or taste; pileus white, on drying discolored yellowish, bluish, greenish, or brownish, spongy and watery drying firm, up to 1.5 x 4 x 0.8 cm; below white or in part discolored, the pores 6-8 per mm; tubes up to 2.5 mm long; context drying firm-felty, up to 6 mm thick.



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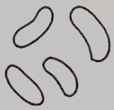

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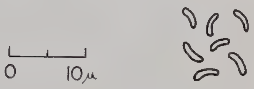

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Fig. 49. Spores of *Polyporus obductus* from isotype at BPI, drawing by K. Aoshima filed with Bresadola Herb. packet. Fig. 50. Spores of *T. palmarum* from isotype at BPI, drawing by J. R. Weir of Underwood and Earle 1142. Fig. 51. Spores of *Polyporus semipileatus* from Lowe 2116 at SYRF.

Sporophore trimitic, the context trimitic, of nodose-septate generative hyphae 3-6 μ in diam, of skeletals 2.5-6 μ in diam, and of binding hyphae 2-4 μ in diam; trama monomitic, the hyphae 2.5-4 μ in diam; cystidioles fusoid; spores hyaline, smooth, inamyloid, allantoid, 3-4 x 0.5-1 μ.

On the wood of angiosperms, widely distributed in North America, Europe, and Asia; associated with a white rot. Type material is at NYS and BPI.

In Europe this fungus has been named *Polyporus chioneus*, "... a name presumed to be misapplied to what is now called *Polyporus* [*Incrustoporia*] *semipileatus* Peck" (Donk 1972, p. 291), and it is the type for *Leptotrimitus* Pouz.

21b. *Trama dimitic, with skeletals (see also 21c)*
  22a. *Pores 6-9 per mm*

52. POLYPORUS FULVITINCTUS Berk. & Curt. Fig. 52

Tyromyces fulvitinctus (Berk. & Curt.) Murr.

Sessile; pileus convex, up to 4 x 4 x 0.5 cm, above cream to tan, glabrous or in part appressed-fibrillose, in part thin-pelliculose; pores 8-9 per mm; tubes to 4 mm long; context tan, rather soft-felty, to 2 mm thick.

Sporophore trimitic, the context trimitic, of nodose-septate generative hyphae 1.5-3 μ in diam, of skeletals 3-9 μ in diam, and of binding hyphae 1.5-4 μ in diam; trama dimitic, with skeletal hyphae; cystidia none; spores somewhat uncertain - none seen attached, probably hyaline, smooth, cylindrical, 6.5-8 x 2-3 μ, or "5.5-7.5 x 1.7-2.3 μ" (Pegler), or "subglobose to ovoid, smooth, hyaline, 3-4 μ" (Murrill).

Known from the Caribbean Islands. Type material is at K, BPI, FH, and NY.

53. POLYPORUS NIVOSUS Berk. Fig. 53

Sessile, solitary or imbricate, taste slightly acid, of medium weight when dry; pileus convex, dimidiate, drying rather hard, up to 6 x 5 x 1.2 cm, above whitish to cream or grayish, nearly glabrous, in some places somewhat resinous and pelliculose, azonate, the margin rather acute, somewhat wavy; pore surface dark cream, dull, the pores angular, about 6-8 per mm, dissepiments rather thin, entire; tubes corky, waxy, up to 6 mm long; context cream, firm, up to 7 mm thick.

Sporophore trimitic, the context trimitic, of thick-walled, occasionally nodose-septate generative hyphae 2.5-4 μ in diam, of skeletal hyphae 2.5-4 (-6) μ in diam, and of binding hyphae 2-4 μ in diam; trama dimitic, of similar generative and skeletal hyphae; gloeoplerous hyphae present; cystidia none; spores hyaline, smooth, inamyloid, oblong, apiculate, 5.5-7.5 x 2-3 μ.

Known from the Caribbean Islands and from South America; type of rot unknown. Type material is at K and BPI.

The hyphae identified above as skeletal differs from the generative hyphae only in the apparent absence of cross walls. If these hyphae are rarely nodose-septate generative hyphae, as D. N. Pegler believes, then this species would be a valid one in *Tyromyces*.

22b. *Pores 4-6 per mm*

54. POLYPORUS DURESCENS Overh.[1/] Fig. 54

Sessile, taste slowly disagreeable; pileus convex, corky when dry, up to 10 x 16 x 4 cm, above white or gray-

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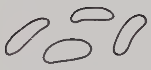
[1/] As this species has not been validated by a Latin description, a validating diagnosis is supplied here:

POLYPORUS DURESCENS Overholts sp. nov. - Pileo sessili, siccante duro et rigido, dimidiato, 4-12 cm longo, 5-15 cm lato, 1-4 cm crasso, albo vel canescente, superne spongioso-tomentoso et plerumque exsiccante aspero; contextu crasso 1-3 cm; hyphis in diametro (3-) 4-6 μ; poris 3-4 pro mm; sporis cylindratis, hyalinis, 4.5-7 x 1.5-2.5 μ; cystidiis nullis.

In ligno arborum Fagi, West Elkton, Ohio, U. S. A., July 28, 1917, typus in herbario Overholtsii ut No. 4215 in PAC conservatus.

Described in English in Mycologia 33:98. 1941.

ish and discoloring on drying, finely appressed-tomentose or drying rough and somewhat tuberculate; pores round to



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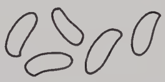

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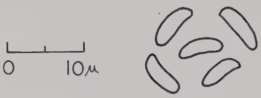

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Fig. 52. Spores of *Polyporus fulvitinctus* from type at K, drawing by D. Pegler of Wright 136. Fig. 53. Spores of *Polyporus nivosus* from type at K, Spruce 192. Fig. 54. Spores of *Polyporus durescens* from Overholts Herb. 2142 at PAC.

angular, about 4-5 per mm; tubes to 1 cm long; context to 3 cm thick.

Sporophore trimitic, the context trimitic, of nodose-septate generative hyphae 2.5-7 µ in diam, of skeletals 2.5-6 µ in diam, and of rather rare binding hyphae in small knots, 2.5-6 µ in diam; trama dimitic, with skeletal hyphae; cystidia none; spores hyaline, smooth, inamyloid, frequently apiculate, cylindrical or sometimes narrowed at one end, 5-7 x (1.5-) 2-2.5 µ.

On the wood of angiosperms from New York westward and southward to Indiana, Florida, and Louisiana; associated with a brown rot. *Polyporus palustris* is extremely similar, but differs in having spores 6-10 x 1.5-3.5 µ, and in usually occurring on the wood of gymnosperms. *Polyporus spraguei* is also very similar but its spores are ovoid to subglobose, 4.5-7 x 4-5 µ.

Overholts states (1953, p. 284) that *P. durescens* differs from *P. spraguei* most obviously in its spores. The designated type, Overholts Herb. No. 4215 at PAC, is sterile. This designation of type is probably an error; a much better choice would have been No. 2142, from the same locality. Type material is at PAC, BPI, and SYRF.

55. POLYPORUS PALUSTRIS Berk. & Curt. Fig. 55

Tyromyces palustris (Berk. & Curt.) Murr. *Polyporus radula* Lloyd, Mycol. Writ. 5, Letter 67:12. Note 652. 1918 (BPI; K).

Sessile, solitary to somewhat imbricate, without distinctive odor or taste; pileus convex, dimidiate, up to 10 x 20 x 3 cm (Overholts), above cream to reddish tan, glabrous, azonate, the margin rounded, below with a narrow sterile border; pore surface tan, somewhat glancing, the pores rounded, 4-6 per mm, dissepiments thin, entire; tubes drying rigid, fragile, up to 10 mm long; context cream, firm-felty, up to 2.5 cm thick.

Sporophore trimitic, the context trimitic, of frequently branched, both thin- and thick-walled, nodose-septate generative hyphae 2.5-4 μ in diam, of similar except uniformly thick-walled skeletal hyphae 3-6 μ in diam, and of binding hyphae 2.5-5 μ in diam; trama dimitic, of similar generative and skeletal hyphae; gloeoplerous hyphae present; cystidia none; spores hyaline, smooth, inamyloid, apiculate, oblong, 6-7.5 (-10) x (1.5-) 2.5-3 (-3.5) μ.

On wood of gymnosperms and occasionally of angiosperms in eastern U.S., in the Bahamas, and in Trinidad; associated with a brown rot, see Hepting (1971). Polyporus spraguei is extremely similar externally but that has ovoid to subglobose spores 4.5-7 x 4-5 μ. P. durescens is also very similar but differs in having more slender spores 1.5-2.5 μ wide. Cultural comparison of P. palustris and material identified as P. durescens is presented by McKay (1962).

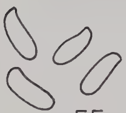
The hyphae identified above as skeletal differs from the generative hyphae only in the apparent absence of cross walls. If these hyphae are rarely nodose-septate generative hyphae, as D. N. Pegler believes, then this species would be a valid one in Tyromyces.

Type material is at K and NY.

56. TYROMYCES NIVOSELLUS Murr. Fig. 56

Sessile, somewhat acid in taste; pileus convex, up to 3 x 9 x 4 cm, above whitish, glabrous; pore surface sordid cream-brownish, the pores 4-5 per mm; tubes drying papery-tough, up to 1.5 cm long; context cream-white, corky, up to 2.5 cm thick.

Sporophore trimitic, the context trimitic, of nodose-septate generative hyphae 2-5 μ in diam, of skeletals 3-6 μ in diam, and of binding hyphae 2-3 μ in diam; trama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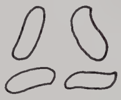
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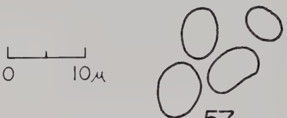

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Fig. 55. Spores of *Polyporus palustris* from type at K, Ravenel 1566. Fig. 56. Spores of *T. nivosellus* from type at NY, Underwood and Earle 1114. Fig. 57. Spores of *Polyporus spraguei* from Lowe 3720 at SYRF.

dimitic, with skeletal hyphae; cystidia none; spores hyaline, smooth, inamyloid, oblong-ellipsoid, apiculate, 6.5-8 x 2.5-3 μ.

On palm in Cuba, very similar to *P. palustris* which occurs on wood of gymnosperms (see comments under that species). Type material is at NY, BPI, K, and SYRF.

21c. *Trama trimitic*
  23a. *Spores 3-9 μ long*

57. POLYPORUS SPRAGUEI Berk. & Curt. Fig. 57

Tyromyces spraguei (Berk. & Curt.) Murr.

Sessile or effused-reflexed, drying hard, often with a disagreeable odor; pileus applanate to convex, appressed-tomentose to glabrous, up to 10 x 15 x 3 cm, dull white throughout or blackening on drying, particularly at the margin; pores 4-5 per mm; tubes to 10 mm long; context firm, fibrous, to 2.5 cm thick.

Sporophore trimitic in both context and trama, the generative hyphae nodose-septate, 3-5 μ in diam, skeletals 2.5-4 μ in diam, and binding hyphae, often poorly developed, 1.5-3 μ in diam; cystidia none; spores hyaline, smooth, inamyloid, ovoid to subglobose, 4.5-7 x 4-5 μ.

On wood of angiosperms or rarely of gymnosperms, widely distributed in the eastern half of the United States and in Ontario; associated with a brown rot, see Boyce (1961) and Hepting (1971).

Type material is at K and BPI.

58. SPONGIPELLIS LURIDESCENS Murr. Fig. 58

Sessile, when dry light in weight and punky; pileus convex, up to 4 x 5 x 2 cm, above reddish- or grayish-brown, matted-tomentose; pore surface rather dark brown, the pores 1-2 per mm; tubes to 7 mm long; context cinnamon, up to 6 mm thick.

Sporophore trimitic in both context and trama, the generative hyphae unobserved, skeletals 3-7 µ in diam and binding hyphae 2-4 µ in diam; cystidia hyphoid; spores "ellipsoidal, smooth, hyaline, 3-4 x 1-2 µ" (Murrill), or more probably "5 x 3" (author unknown).

On wood in Jamaica and Mexico. Type material is at NY, BPI, K, and SYRF.

59. TRAMETES SQUALENS Karst. Plate I F and Fig. 59

Polyporus anceps Peck. _Tyromyces anceps_ (Peck) Murr.

Sessile or effused-reflexed, with a mild taste; pileus firm-corky, up to 3 x 7 x 1.5 cm, above white or discolored brownish or blackish, often drying rough and somewhat tuberculate; pores 3-4 per mm; tubes to 1 cm long; context corky, up to 5 mm thick.

Sporophore trimitic, the context and trama of nodose-septate generative hyphae 2-5 µ in diam, skeletals 3-6 µ in diam, and with bovistoid binding hyphae; cystidia none; spores hyaline, smooth, inamyloid, oblong, 7-9 x 2.5-3 µ.

On the wood of gymnosperms throughout the temperate parts of the Northern Hemisphere; associated with a rot at first red then becoming a white pocket rot, see Boyce (1961) and Hepting (1971).

This fungus is the type species in a new genus and species combination, _Dichomitus squalens_ Reid, Revista de

Biol. 5:149-150. 1965. Reid considers the hyphal system to be dimitic, with generative and arboriform skeletal hyphae.

60. TYROMYCES CALKINSII Murr. Fig. 60

Sessile, somewhat acid to taste; pileus convex, up to 5 x 7 x 2 cm, above white drying somewhat discolored cream or brownish, glabrous; pores 5-6 per mm; tubes drying rather soft and fragile, up to 1 cm long; context drying rather soft and radially fibrous, up to 1.2 cm thick.

Sporophore trimitic in both context and trama, of nodose-septate generative hyphae 3-8 μ in diam, skeletals 3-7 μ in diam, and of binding hyphae 2.5-4 μ in diam; cystidia none; spores absent in type, in other material hyaline, smooth, inamyloid, oblong to oblong-ellipsoid, 5.5-7 (-8) x 2.5-4 μ.

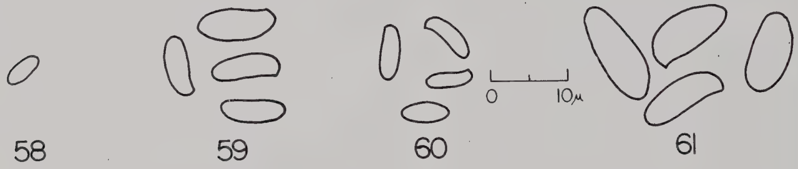

Fig. 58. Spore of *Spongipellis luridescens* from drawing filed with type at NY, Earle 114. Fig. 59. Spores of *Trametes squalens* from Lowe 3097 at SYRF. Fig. 60. Spores of *Tyromyces calkinsii* from Overholts Herb. 9977 at PAC. Fig. 61. Spores of *Tyromyces magnisporus* from type at FLAS, F 17916.

On the wood of angiosperms in Florida; for pathological information see Hepting (1971). This is very similar to *Trametes submurina* Murr. which dries more or less mouse-gray, without a pellicle, has corky context and tubes, and more slender generative hyphae 2.5-4 μ in diam. See comments under *P. palustris* on similarities to that species and to *T. nivosellus* and to *P. durescens*.

Overholts' record (1953, p. 316) of globose spores for this species was probably based on contaminant spores. Spores as given above were found on type material by Setliff, Weir, and myself, and also on Overholts 9977 (at PAC), and on Earle 161 and Martin 4096 (at NY).

Type material is at NY, BPI, K, and SYRF.

23b. *Spores 10-14 μ long*

61. TYROMYCES MAGNISPORUS Murr. Fig. 61

Sessile, solitary to "subimbricate" (Murrill), taste "very bitter" (Murrill), or when dry somewhat resinous, when fresh "fragrant like anise" (Murrill); pileus applanate or turbinate when encircling substrate, drying rigid, "4-5 cm broad and 2-3 cm thick" (Murrill), above yellowish brown, mostly glabrous, below pale wood-brown; pores 3-4 per mm; tubes up to 1 cm long; context pale wood brown, up to 2 cm thick.

Sporophore trimitic, the context and trama of generative hyphae with clamps, 2.5-4 μ in diam, skeletals 3-5 μ in diam, and binding hyphae 1-3 μ in diam; cystidia none; spores hyaline, smooth, inamyloid or slightly dextrinoid, narrowly ellipsoid and often truncate at end opposite apiculus, 10-14 x 4-7 μ.

On wood of angiosperms in Florida, known only from the type collection at FLAS.

SPECIES OF UNKNOWN AFFINITIES

Leptoporus mexicanus Pat., Soc. Myc. France Bull. 14:55. 1898. Type from Mexico is a very poor sample which may never be known with certainty. Type is at FH.

Leptoporus nauseosus Pat. *in* Duss, Enum. Méth. Champ. Guadeloupe, p. 27. 1903. Type from Guadeloupe, a specimen without tubes, is doubtfully a polypore. Type is at FH.

ADDENDA

Material of the species discussed below were studied too late to be included in the normal place in the manual.

Polyporus caesio-flavus Pat., described from Ecuador in Soc. Myc. France Bull. 8:114. 1892 - type at FH, is very similar to *T. caesius* and *T. tephroleucus* but seems to differ in having a more yellowish color, and in smaller pores, 6-7 per mm. Patouillard considered it close to "*P. lacteus*" (= *T. tephroleucus* of this manual).

Polyporus canaliculatus Pat., described from Java in Soc. Myc. France Bull. 14:153. 1898-type at FH, has large cystidia like those in *T. semisupiniformis*, but differs from that species in having simple-septate hyphae and larger spores, 4-5 μ in diameter. The specific name refers to radiating reddish resinous streaks in the context.

Leptoporus caseosus Pat., described from Brazil in Ann. Mycol. 5:365. 1907-type at FH, is extremely similar to *T. spumeus* var. *malicola* but may differ in having less indurated context and tubes.

Polyporus concrescens Mont. was reported by Duss (1903, p. 26) from Guadeloupe and Martinique, and Duss 665 is in the Patouillard Herbarium at FH. As the specimen is sterile a satisfactory determination cannot be made, but the specimen is noteworthy as it has a pendent habit like *T. minusculoides* and *T. subpendulus* but differs decidedly in having simple-septate hyphae. Additional material is at S, probably isotype from Juan Fernandez Is., and from Ecuador. Cystidia are present in some of the Stockholm material.

Polyporus gossypinus Lév., described from France in Ann. Sci. Nat. Bot. 3,9:124. 1848, if correctly represented by a specimen at FH, from Tunisia, identified by Patouillard who annotated it "comparé avec le type ex Lév.!", resembles *T. minusculoides* in its habit and many other features but differs in forming a much larger sporophore and in having more slender spores, 1-1.5 μ wide. Bresadola (1916, p. 224) however, refers this species to *T. caesius* and Bourdot and Galzin (1928, p. 541) appear to accept this synonomy.

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ADDENDUM

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WOOD-INHABITING HOMOBASIDIOMYCETES ON SAGUARO IN ARIZONA

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SUMMARY

Twelve species of lignicolous Homobasidiomycetes are reported from saguaro in Arizona. Three new species, *Coniophora eremophila*, *Coprinus papagoensis*, and *Nidularia griseolazulina* are described.

The saguaro cactus, *Carnegiea gigantea* (Engelm.) Britt. & Rose, is a prominent element of the Sonoran Desert flora in southern Arizona and northwestern Mexico. It is the only large columnar cactus in great numbers in the United States, and is therefore a major tourist attraction in Arizona. In addition to its biological and aesthetic interest, the saguaro plays a key role in maintaining the ecological balance of the desert. The fibrous roots of the plant bind the loose desert soils together (Shelton, 1972), the trunk and arms act as nesting sites for such birds as the Gila woodpecker and the elf owl, and the fruit has provided a food and beverage source for the Papago Indians for many years (Benson, 1969).

The saguaro prefers well-drained slopes and foothill areas in the Lower Sonoran Desert zone. It ranges from northern Arizona along the Colorado River to northern Sonora, Mexico, and occurs just west of the Colorado River in southeastern California (Shreve and Wiggins, 1964).

Saguaros appear to be on the decline around the Tucson area in particular (Hastings and Turner, 1965), and have been the subject of several studies concerning organisms which might contribute to this decline. Lightle, Standring,

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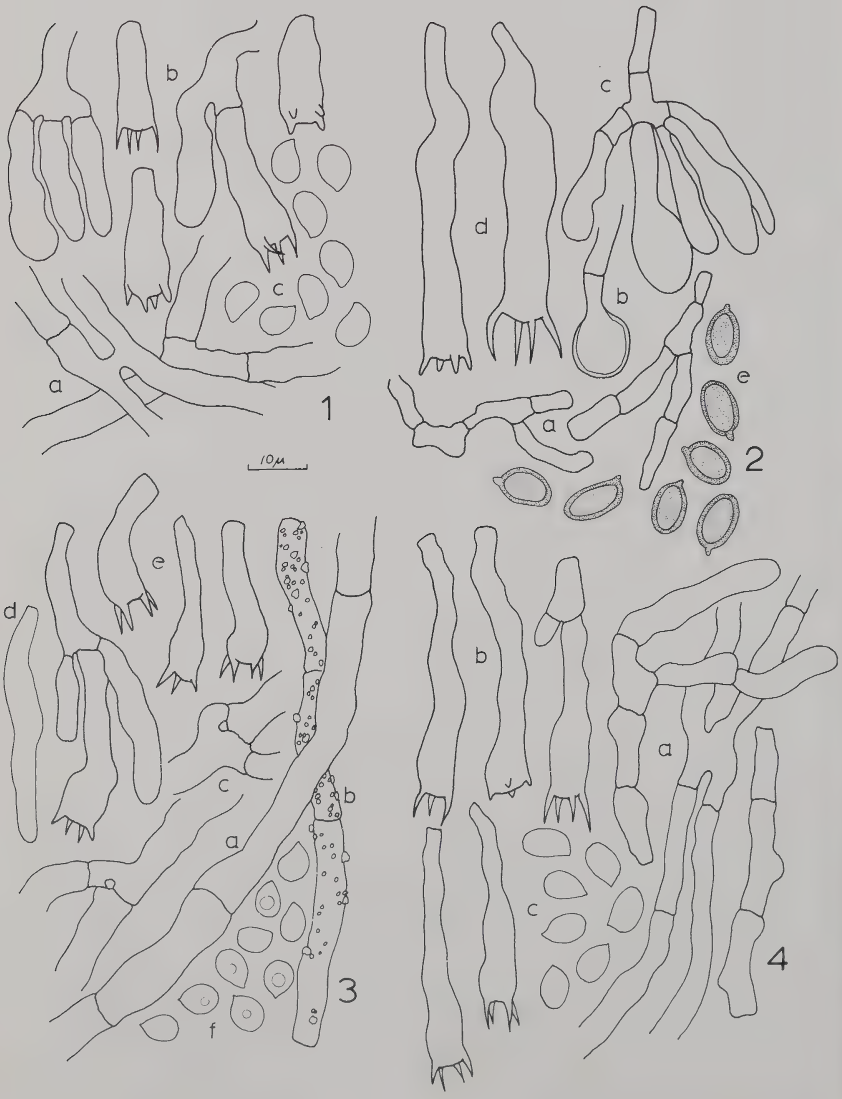
University of Arizona Agricultural Experiment Station Journal article No. 2402.

and Brown (1942), Boyle (1949), and Alcorn and May (1962) investigated a bacterial rot caused by *Erwinia carnegieana* Standring. Davidson and Mielke (1947) worked with a heart rot fungus, *Phellinus texanus* (Murr.) Gilbertson et Canfield, which decays wood in mature standing cacti. Davidson and Mielke referred this fungus to *Fomes robustus* Karst. Gilbertson and Canfield (1972) studied *Poria carnegiea* Baxter, a fungus which apparently enters and weakens roots of standing plants, predisposing them to windthrow.



Hepting (1971) summarizes knowledge of pathology of saguaro and states that it "supports fewer recorded pathogens or otherwise destructive micro-organisms than any other American tree". Other organisms that decay saguaro have not yet been reported. This paper describes 12 Homobasidiomycetes known to decay the woody tissues of saguaro. All collections cited are from saguaro unless otherwise specified. Capitalized color names are from Ridgway (1912). All voucher specimens are in the University of Arizona Herbarium (ARIZ) unless otherwise specified.

ATHELIA DECIPIENS (Hoehn. et Litsch.) John Erikss., Symb. Bot. Upsalienses 16:1, p. 86. 1958.

Corticium decipiens Hoehn. et Litsch., Sitz. ber. Akad. Wiss. Wien Math.-nat. Kl. Bd. 117(1): 1116. 1908.

Basidiocarps pellicular, becoming widely effused, thin, fragile, easily separable from substratum; hymenial surface white to grayish-white, smooth, cracking on drying; hymenial layer very thin, discontinuous; subiculum delicate, whitish, arachnoid, in some areas so inconspicuous the hymenial layer appears to be directly on the substratum; subicular hyphae (Fig. 1a) simple-septate with no clamp connections, thin- to moderately thick-walled, often incrusted, with frequent branching, 2-5 µm in diam, with prominent right angle branching; cystidia lacking; basidia (Fig. 1b) in candelabrums, compactly arranged in a euhymenium, clavate, 10-25 x 6-8 µm, 4-sterigmate, with a basal septum; basidiospores (Fig. 1c) oblong to ellipsoid, hyaline, smooth, negative in Melzer's reagent, (4-)5-8 x 4.5-5.5 µm, with a small but prominent apiculus.

Fig. 1, *Athelia decipiens* (RLG 10814), a, subicular hyphae; b, basidia; c, basidiospores. Fig. 2, *Coniophora eremophila* (JPL 101), a, subicular hyphae; b, inflated hyphal element from subiculum; c, cluster of immature basidia; d, basidia; e, basidiospores. Fig. 3, *Phanerochaete chrysorhizon* (JPL 72), a, simple-septate subicular hypha; b, lightly incrusted simple-septate subicular hypha; c, subicular hyphae with clamp connections; d, cystidium; e, basidia; f, basidiospores. Fig. 4, *Phanerochaete tuberculata* (RLG 10570 and 10544), a, subicular hyphae; b, basidia, c, basidiospores.

Athelia decipiens occurs in all vegetational zones in Arizona from Sonoran Desert to coniferous forests. It is associated with a uniform white rot.

Voucher specimen: RLG 10814, Saguaro Nat. Monument, West unit, Pima County, AZ (ARIZ).

CONIOPHORA EREMOPHILA Lindsey et Gilbertson, sp. nov.

Fructificatio annua, effusa, fragilis; hymenio superficie laevi; area fecunda olivaceo-brunnea; subiculum album, arachnoideum; margo album, cum rhizomorphae; hyphae septatae, afibulatae, 2-6 µm diam; basidia clavata vel utriformes, 4-sterigmatibus, 50-55 x 6-8 µm; basidiosporis pallido-flavus, dextrinoideis, tunicis incrassatis, ovatis vel cylindrico-ellipsoideis, 9-14 x 5-9 µm. HOLOTYPUS: in ligno *Prosopis juliflora* (Sw.) DC., Canyon del Oro, Santa Catalina Mts., Pinal County, AZ, U.S.A.; leg. R. L. Gilbertson no. 10925; in herb. Nat. Fungus Collections, Beltsville, MD, U.S.A. (BPI).

Basidiocarps fragile, easily separated, becoming widely effused; hymenial surface smooth, colored Light Brownish Olive by the massed basidiospores; hymenial tissue soft and floccose over a white, arachnoid subiculum; margin with fine white mycelial strands from subiculum; subicular hyphae (Fig. 2a) simple-septate, hyaline, thin-walled, mostly 2-6 µm diam but with some cells (Fig. 2b) inflated up to 10 µm, some lightly incrusted; cystidia none; basidia (Fig. 2c, 2d) usually utriform, occasionally clavate, usually sinuous, tapering at the base, 50-55 x 6-8 µm, 4-sterigmate, sterigmata up to 7 µm long; basidiospores (Fig. 2e) brownish-olive in mass, pale yellow in KOH, cyanophilous, dextrinoid in Melzer's reagent, thick-walled, oval to broadly cylindric, 7.5-14 x 5-9 µm with a prominent peg-like apiculus.

Coniophora eremophila also occurs on other Sonoran Desert plants, and is associated with a brown rot.

Coniophora arida (Fr.) Karst.) is a similar species, and is commonly found in coniferous forest regions of Arizona. It differs from *C. eremophila* in having adnate basidiocarps, larger basidia, and larger, more narrowly ellipsoid basidiospores. *C. inflata* Burt, described from Mexico, differs in having occasional single to multiple clamps, hyphoid cystidia, and smaller basidiospores (Ginns, 1973).

Voucher specimens: JPL 101, on saguaro, Saguaro Nat. Monument, West unit, Pima County, AZ; RLG 10925, on dead mesquite (*Prosopis juliflora* (Sw.) DC.), Canyon del Oro, Santa Catalina Mts., Pinal County, AZ. HOLOTYPE, BPI: RLG 10812, on dead ironwood (*Olneya tesota* Gray), Saguaro Nat. Monument, West unit, Pima County, AZ; RLG 10875, on dead ironwood, Santa Rosa Valley, Papago Indian Reservation, Pinal County, AZ; RLG 10936, on Mexican elderberry (*Sambucus mexicana* Presl.), Tanque Verde Wash, Pima County, AZ; ERC 71-344, on desert willow (*Chilopsis linearis* (Cav.) Sweet), Lochiel, Santa Cruz County, AZ; RLG 10894, on Arizona black walnut (*Juglans major* (Torr.) Heller), Gardner Canyon Rd., Santa Cruz County, AZ (ARIZ).

PHANEROCHAETE CHRYSORHIZON (Torr.) Gilbertson et Budington, Southwestern Nat. 17(4): 417. 1973.

Hydnum chrysorhizon Torr. in Eaton, Manual of Botany, ed. 3, p. 309. 1822.

Basidiocarps effused in small patches, fragile, pellicular, easily separated from the substratum; hymenial surface bright orange-yellow to cream-colored, becoming strongly hydnaceous, the teeth cylindric, up to 1 mm long; margin rhizomorphic with white, plumose fans of radiating rhizomorphs in arachnoid mycelium; yellow to cream rhizomorphs usually present on substratum and in adjacent soil and litter; hyphal system monomitic; subicular hyphae smooth or lightly incrusted (Fig. 3b), 4-8 µm diam with abundant simple septa (Fig. 3a) and occasional single or double clamp connections (Fig. 3c), cystidia (Fig. 3d) few, cylindric, thin-walled, 3-4 µm diam, projecting to 25 µm; basidia (Fig. 3e) clavate, 4-sterigmate, septate at the base, 20-30 x 5.5-7 µm; basidiospores (Fig. 3f) broadly ellipsoid, hyaline, negative in Melzer's reagent, smooth, 5-6 x 4-4.5 µm.

Phanerochaete chrysorhizon is found on other native desert plants and is also common on dead cotton stems and roots. The decay is a uniform white rot.

Voucher specimen: JPL 72, Saguaro Nat. Monument, West unit, Pima County, AZ (ARIZ).

PHANEROCHAETE TUBERCULATA (Karst.) Parm., Conspect. Syst. Cortic., p. 83. 1968.

Corticium tuberculatum Karst., Hedwigia 35: 45. 1896.

Basidiocarps annual, adnate, becoming widely effused; hymenial surface tuberculate, deeply cracked when dry, Cinnamon-Buff to Clay-Color; margin thinning out, white, arachnoid; hyphal system monomitic, subicular hyphae (Fig. 4a) thin-walled, hyaline, simple-septate, sometimes incrusted, 2.5-5 µm diam; cystidia none; basidia (Fig. 4b) clavate, 4-sterigmate, simple-septate at base, 35-45 x 6-7 µm; basidiospores (Fig. 4c) 6-9 x 3.5-5 µm, ellipsoid, apiculate, hyaline, smooth, negative in Melzer's reagent.

Phanerochaete tuberculata is associated with a white rot of a number of Sonoran Desert plants and decays dead branches on standing plants as well as wood on the ground. The diagnostic characters are the cracked, tuberculate basidiocarps and absence of clamp connections and cystidia.

Voucher specimens: RLG 10544, Camp Grant Wash, San Pedro River Valley, Pinal County, AZ; RLG 10570, Saguaro Nat. Monument, West unit, Pima County, AZ; JPL 133, Saguaro Nat. Monument, East unit, Pima County, AZ (ARIZ).

PENIOPHORA TAMARICICOLA Boid. et Malençon, Rev. Mycol. 26: 153. 1961.

Basidiocarps becoming widely effused, adnate, drying tough and horny, cracking extensively on drying into small angular blocks; hymenial surface smooth to distinctly tuberculate, pruinose, pink when fresh, pale purplish-gray on dried specimens (Pale Smoke Gray, Pallid Mouse Gray, or Gull Gray); margin abrupt and fertile; subiculum pale brown, hymenial layer distinct and whitish in longitudinal section; hyphal system apparently monomitic; subicular hyphae (Fig. 5a) agglutinated, difficult to separate, 3-4 µm in diam, thin- to thick-walled, with some inconspicuous clamp connections; vesicular gloeocystidia (Fig. 5b) present in subiculum, some with refractive granular contents, dark bluish-black in sulfobenzaldehyde reagent; hymenial gloeocystidia occasional, barely projecting, acuminate, some with refractive contents, light to dark bluish-black in sulfobenzaldehyde reagent; dendrohyphidia present, lightly incrusted, 2-3 µm diam, sparsely branched at apex;

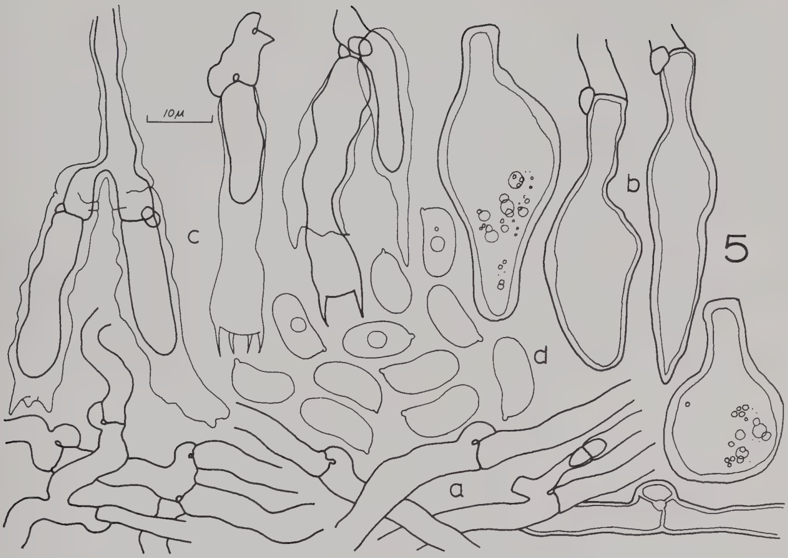


Fig. 5. *Peniophora tamaricicola* (JPL 137), a, subicular hyphae; b, gloeocystidia; c, basidia, showing percurrent development; d, basidiospores.

basidia (Fig. 5c) clavate, 4-sterigmate, 25-40 x 7-7.5 µm, developing percurrently; basidiospores (Fig. 5d) hyaline, negative in Melzer's reagent, smooth, cylindric to allantoid, 10.5-11.5 x 4-4.5 µm.

P. tamaricicola is associated with a white rot of dead branches of a number of desert trees and shrubs (Gilbertson, et al., 1974; Gilbertson and Burdsall, 1975) and is particularly common on mesquite.

Voucher specimen: JPL 137, Saguaro Nat. Monument, East unit, Pima County, AZ (ARIZ).

HYPHODERMA CLAVIGERUM (Bres.) Donk, Fungus 27: 15. 1957.

Kneiffia clavigera Bres., Ann. Mycol. 1: 103. 1903.

Basidiocarps annual, effused, adnate; hymenial surface white, smooth, pilose under 30X lens; hyphal system monomitic, subicular hyphae (Fig. 6a) thin-walled 2.5-4 µm diam

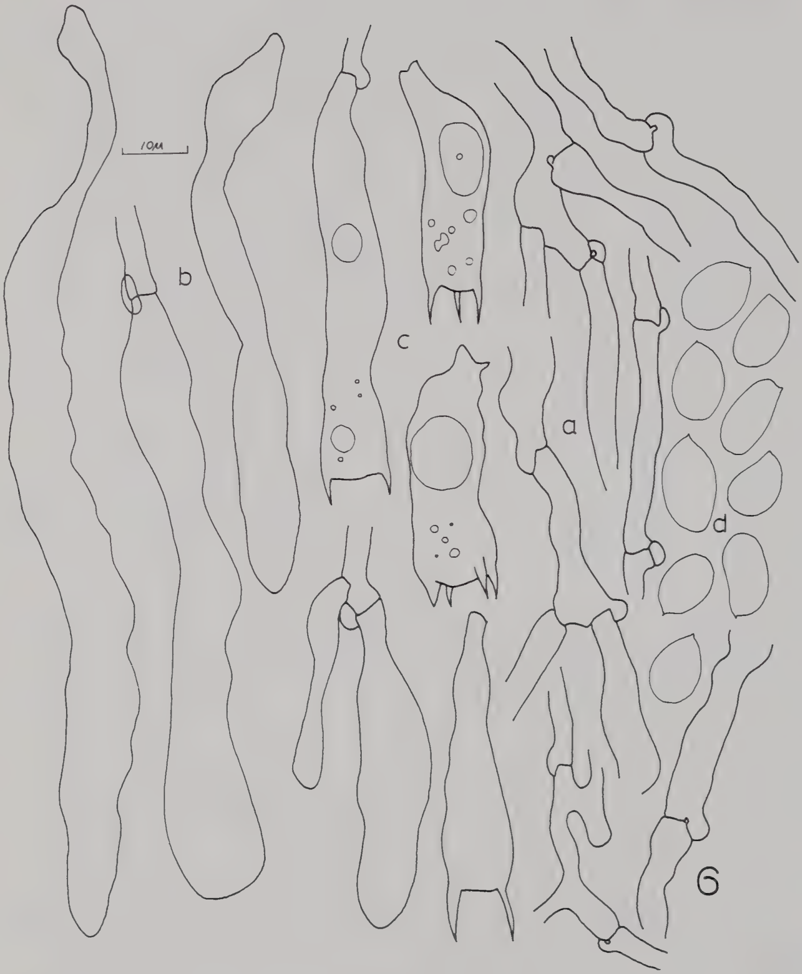


Fig. 6. *Hyphoderma clavigerum* (Alcorn specimen), a subicular hyphae; b, cystidia; c, basidia; d, basidiospores.

or some swollen to 7 µm at the septa, with clamp connections at all septa and frequent branching; cystidia (Fig. 6b) frequent, clavate to fusoid, thin-walled, not incrusted, 70-120 x 9-13 µm; basidia (Fig. 6c) clavate, 4-sterigmate, usually with a slight median constriction, 30-55 x 8-11 µm; basidiospores (Fig. 6d) hyaline, negative in Melzer's reagent, smooth, ellipsoid to cylindric-ellipsoid, 9-13 x 5.5-7 µm.

Hyphoderma clavigerum is associated with a white rot.

Voucher specimen: Stanley M. Alcorn collection, on dead tissue of live saguaro, Saguaro Nat. Monument, East unit, Pima County, AZ (ARIZ).

PHELLINUS TEXANUS (Murr.) Gilbertson et Canfield, Mycologia 65: 1304. 1972.

Pyropolyporus texanus Murr., N. Am. Fl. 9: 104. 1908.

Basidiocarps perennial, sessile, ungulate, up to 15 cm wide; upper surface at first pale brown, matted-tomentose, becoming blackened and deeply rimose with age and weathering, sulcate; margin rounded, pale brown and tomentose; pore surface pale brown (near Buckthorn Brown), smooth, the pores 4-6 per mm; dissepiments finely tomentose, entire context hard and woody, yellowish-brown, appearing mottled with streaks of paler tissue; tube layers stratified, becoming stuffed with light colored mycelium; sections permanently darkening in KOH solution; contextual hyphae thin-walled, hyaline (Fig. 7a) to brown, 2-5 µm in diam, with moderately thickened walls (Fig. 7b), occasional septa, and rare branching; hyphae in the pale-colored areas with a parallel arrangement, easily separated, hyphae in the darker areas densely interwoven, contorted, difficult to separate; tramal hyphae interwoven, 2-4 µm diam, pale yellowish, with slightly thickened walls and occasional septa; setae (Fig. 7d) few, thick-walled at maturity, with inflated base to 10 µm diam and 25-60 µm long, with a slender apical portion; setae apparently developing from hyaline, thin-walled cystidioid hyphal ends (Fig. 7c) similar in shape and size to the setae, common in all sections; basidia (Fig. 7e) ovoid to subglobose, 17-25 x 8.5-12 µm, 4-sterigmate, the sterigmata slender, up to 4 µm long; basidiospores (Fig. 7f) subglobose, hyaline, strongly dextrinoid in Melzer's reagent and with distinctly thickened walls when mature, 7-9 x 6.5-9 µm.

Phellinus texanus decays the heartwood of many desert shrubs and trees (Gilbertson et al., 1974). On saguaro the basidiocarps develop under the arms and are very inconspicuous. Davidson and Mielke (1947) report that *P. texanus* also causes decay in the base of saguaros. The decay is a

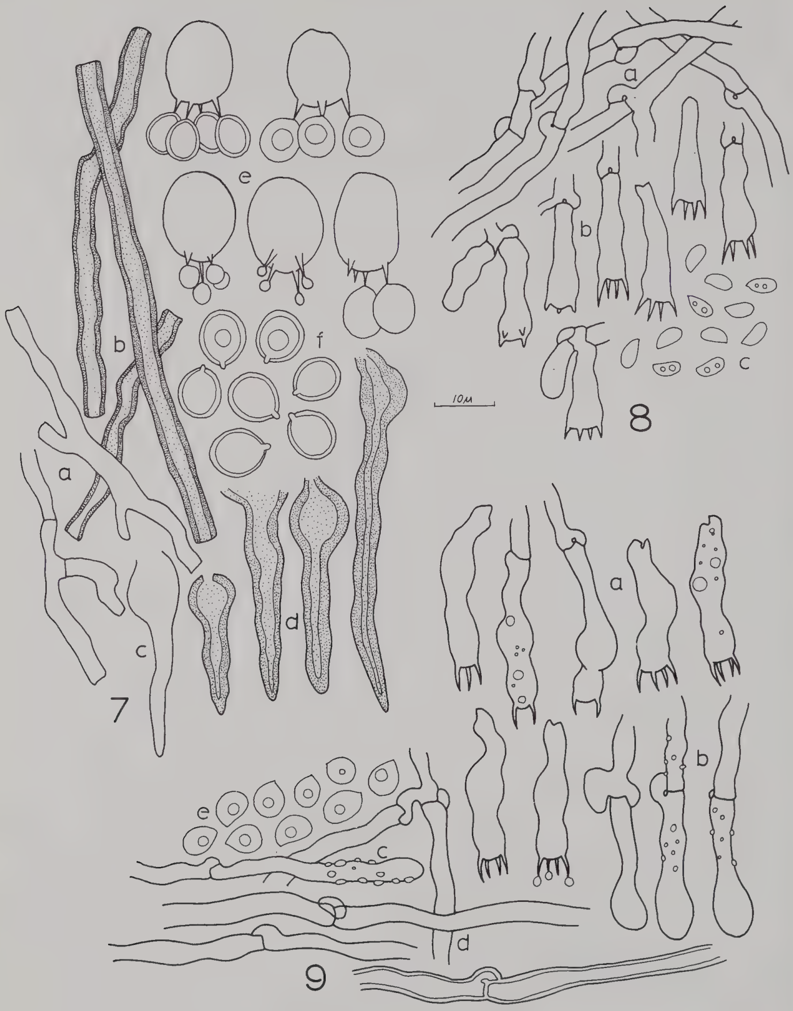


Fig. 7. *Phellinus texanus* (RLG 6959), a, pale thin-walled septate hyphae; b, thick-walled pigmented hyphae; c, thin-walled hyaline immature seta; d, thick-walled pigmented mature setae; e, basidia; f, basidiospores. Fig. 8. *Poria carnegiea* (JPL 342), a, subicular hyphae; b, basidia; c, basidiospores. Fig. 9. *Poria apacheriensis* (RLG 11429), a, basidia; b, apically swollen cystidia; c, cylindric cystidium; d, subicular hyphae; e, basidiospores.

uniform white rot with mats of brown mycelium developing in advanced stages.

Voucher specimens: E. R. Canfield 71-73 and 71-74, Redington Rd., Rincon Mts., Pima County, AZ (ARIZ).

PORIA CARNEGIEA Baxter, Pap. Michigan Acad. Sci. 26: 110. 1941.

Basidiocarps effused up to 3 m, annual, cracking deeply in older specimens; pore surface almost white to ivory-white when fresh, drying tan or Light Buff, the pores angular, 2-4 per mm with thin dissepiments that split on aging or drying; margin sometimes abrupt and fertile, or if sterile then white, finely fimbriate or fibrillose; tube layer soft and easily crushed when fresh, drying buff, brittle, up to 1 cm thick; subiculum less than 1 mm thick, soft-fibrous, ivory-white; subicular hyphae (Fig. 8a) 2-4 µm diam, thin-walled, with abundant clamp connections, with occasional branching; tramal hyphae similar, with more frequent branching; cystidia none; basidia (Fig. 8b) clavate, 4-sterigmate, 16-19 x 7-7.5 µm with a basal clamp connection; basidiospores (Fig. 8c) oblong to short-cylindric, hyaline, smooth, negative in Melzer's reagent, 4.5-5.5 x 2-2.5 µm; spore print white.

Poria carnegiea has never been found on substrata other than saguaro. It enters the root systems in standing plants and continues to decay the other woody tissues after the plant has fallen. The decay is a uniform white rot that becomes stringy or laminated in the advanced stages (Gilbertson and Canfield, 1972).

Voucher specimens: JPL 342, Saguaro Nat. Monument, East unit, Pima County, AZ; JPL 316, Organ Pipe Nat. Monument, Pima County, AZ; RLG 10547, Dripping Springs Mts., Pinal County, AZ (ARIZ).

PORIA APACHERIENSIS Gilbertson et Canfield, Mycologia 65: 1117. 1973.

Basidiocarps annual, effused up to 10 cm, adnate, soft-fibrous; pore surface white to Cream Color or Light Buff; margin sterile, tomentose; pores circular to daedaloid, up to 1 mm in diam, mostly 2-3 per mm; tube layer soft-fibrous, white to cream-colored, up to 2 mm thick; subiculum soft, white, less than 0.5 mm thick; hyphal system monomitic; subicular hyphae (Fig. 9d) with abundant clamp connections, thin- to moderately thick-walled, with occasional branching, 2-4 µm diam; tramal hyphae similar, incrusted at dissepiment edges; cystidia thin-walled, of two types, some acicular or cylindric (Fig. 9c), smooth to lightly incrusted, 3-5 µm in diam and projecting to 40 µm, others capitate (Fig. 9b), 3-5 µm diam with swollen apex up to 10 µm in diam, projecting up to 45 µm; basidia (Fig. 9a) with a median constriction, 4-sterigmate, 18-21 x 6-7 µm; basidiospores (Fig. 9e) hyaline, negative in Melzer's reagent, broadly ellipsoid to subglobose, smooth, 5-6.5 x 4-5.5 µm.

Poria apacheriensis occurs on a number of Sonoran Desert plants and causes a white rot (Gilbertson and Canfield, 1973). The only record on saguaro is a basidiocarp found at the base of an arm of a living plant.

Voucher specimen: RLG 11429, Catalina Foothills, Pima County, AZ (ARIZ).

PANUS FULVIDUS Bres., Fungi Trid. II, p. 56. 1900.

Basidiocarps centrally stipitate, single to gregarious; pileus circular, 0.5-3 cm in diam; upper surface pale brown (Cinnamon-Buff to Clay Color), dry, with radially arranged fibrillar scales; stipe cream-colored to pale brown, usually darker at the base, glabrous to minutely pubescent, up to 2 mm diam and 20 mm long; gills pinkish-cream to pale buff when dried, distant, free to adnate, continuous with striations on upper stipe, edges sinuous and distinctly granulose under 30 X lens; most context hyphae (Fig. 10a) filamentous, simple-septate, thin- to slightly thick-walled, 2-5 µm in diam, some very thick-walled (Fig. 10c), with occasional branching, 4-10 µm in diam, usually tapering to a rounded, narrowed apex, but occasionally forming swollen vesicular elements (Fig. 10b); tramal hyphae similar to thin-walled type; pleurocystidia (Fig. 10d) fusoid, barely projecting, thin-walled, 45-60 x 5-6 µm; cheilocystidia similar; basidia (Fig. 10e) clavate, simple-septate at base, 4-sterigmate, 38-55 x 9-15 µm; basidiospores (Fig. 10f) 12-16 x 6-7 µm, broadly cylindric, hyaline, negative in Melzer's reagent.

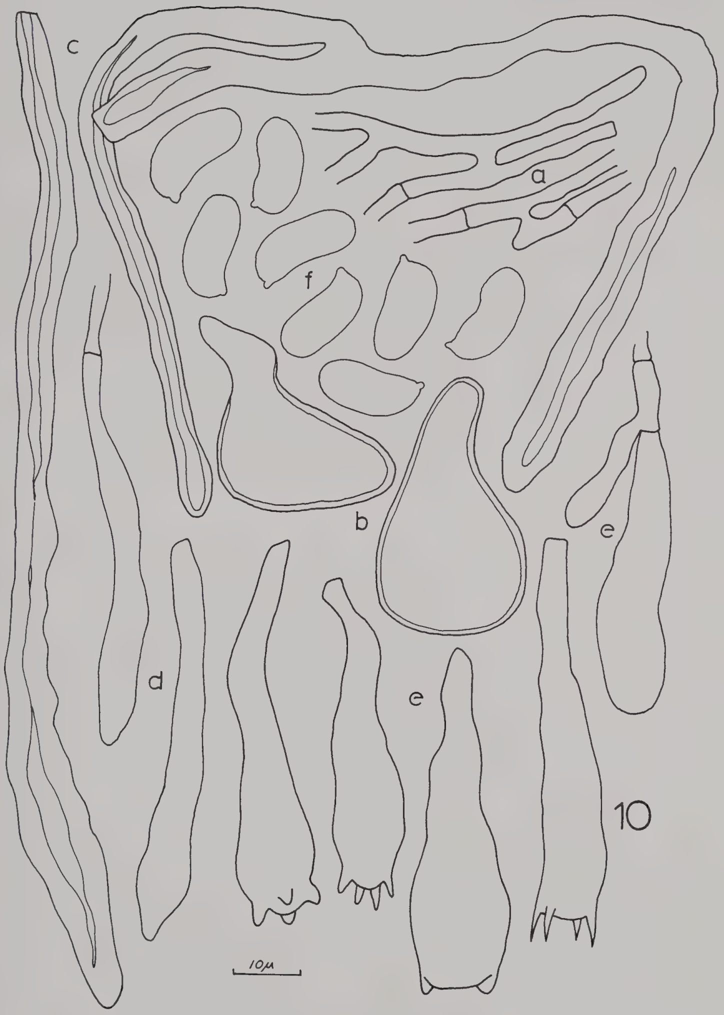


Fig. 10. *Panus fulvidus* (RLG 10258), a, thin-walled septate contextual hyphae; b, swollen vesicular elements from context; c, thick-walled contextual hyphae; d, pleurocystidia; e, basidia; f, basidiospores.

Panus fulvidus also occurs on wood of a number of other plants of the Sonoran Desert and desert grass zones.

It is particularly common on juniper fence posts and causes a brown cubical rot.

Voucher specimen: Gene Milbrath collection, Saguaro Nat. Monument, East unit, Pima County, AZ (ARIZ).

COPRINUS PAPAGOENSIS Lindsey et Gilbertson, sp. nov.

Pileus tenuis, usque ad 3 cm latus, cremicolor, aridus, parvis squamis; stipes pubenti basi, usque ad 8 cm longus, 1.5-2.5 mm crassus; annulo nullo; basidiosporae atri, campanulati, 8-10 µm crassi; basidia 4-sterigmatibus, 9-11 µm diam, 13-21 µm longa; sclerotia rosea vel purpurea, 2-5 mm vel 10 mm diam. HOLOTYPUS: in ligno *Carnegiea gigantea* (Engelm.) Britt. et Rose, Saguaro Nat. Monument, West unit, Tucson Mts., Pima County, AZ, U.S.A.; leg. J. P. Lindsey, no. 97; in herb. Nat. Fungus Collections, Beltsville, MD , U.S.A. (BPI).

Basidiocarps (Fig. 11f) centrally stipitate; pileus up to 3 cm broad, at first convex, becoming plane, upper surface cream-colored to pale buff, dry, with tufts of white to cream-colored tomentum forming scale-like patches on top, distinctly radially striate; margin becoming rolled upward; context thin, whitish; lamellae adnate to slightly decurrent, close, thin, becoming black; stipe up to 8 cm long, 1.5-2.5 mm in diam, white, faintly longitudinally striate, glabrous, with a swollen, densely pubescent base up to 7 mm in diam; contextual hyphae thin-walled, some uniform in diam (Fig. 11d), with clamp connections and simple septa, 2-3 µm diam, others with greatly swollen cells (Fig. 11b), constricted at septa, with distorted and obscure clamp connections, up to 22 µm diam; tramal hyphae similar; pubescence at base of stipe composed of cordons (Fig. 11e) of slender hyphae with clamp connections, cordons 10-20 µm diam; basidia (Fig. 11a) stout, broadly clavate, often with a greatly narrowed base, 4-sterigmate, 13-21 x 9-11 µm, compactly arranged between sterile cells that do not project beyond hymenial surface; basidiospores (Fig. 11c) dark blackish in KOH and Melzer's reagent when mature, bell-shaped, smooth, thick-walled, with an apical germ pore and a blunt, rounded apiculus in the center of the concave, broad base, 8-10 µm wide at the base; spore print jet black.

Sclerotial bodies spherical, 2-5(-10) mm diam when

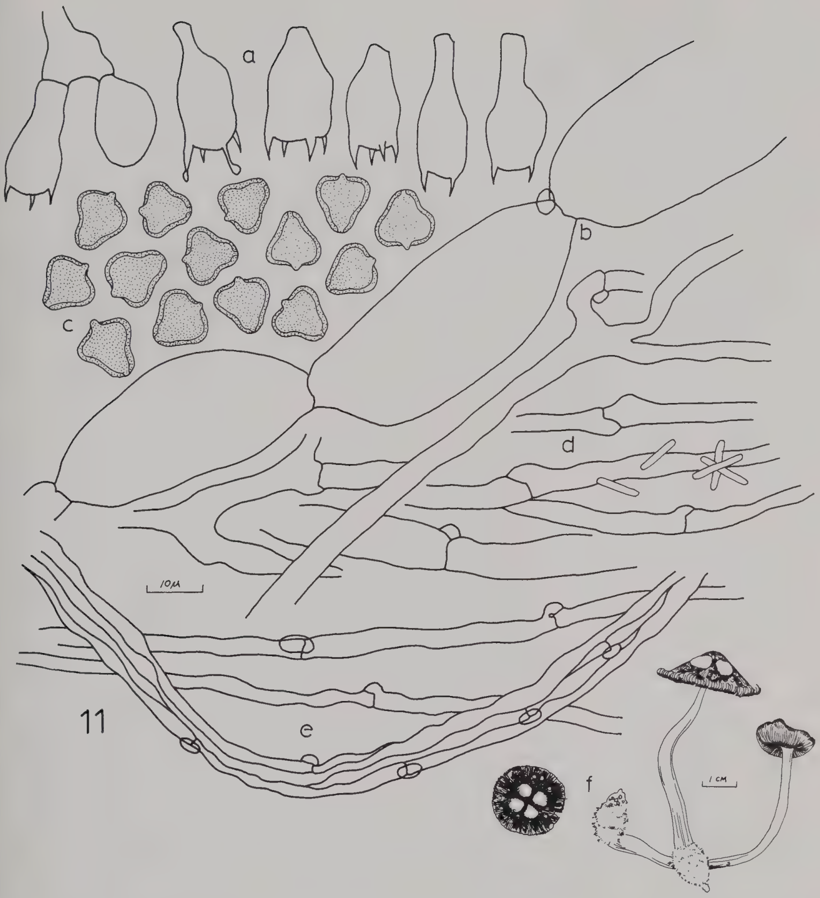


Fig. 11. *Coprinus papagoensis* (basidiocarp stage, JPL 97), a, basidia; b, closely septate swollen contextual hyphae; c, basidiospores; d, slender contextual hyphae; e, cordon; f, basidiocarps.

mature, at first covered by a thin white peridium, becoming pink to dark purple at maturity; immature sclerotial bodies showing a distinct central columella-like structure surrounded by a clearly differentiated zone, this differentiated zone composed of spherical masses (Fig. 12b) of intertwined hyphae, these individual masses 60-80 µm diam; individual hyphae thin-walled, 2.5-5 µm diam with clamp connections; mature sclerotial bodies composed of a solid pink to purplish mass of microsclerotia; mature microsclerotia

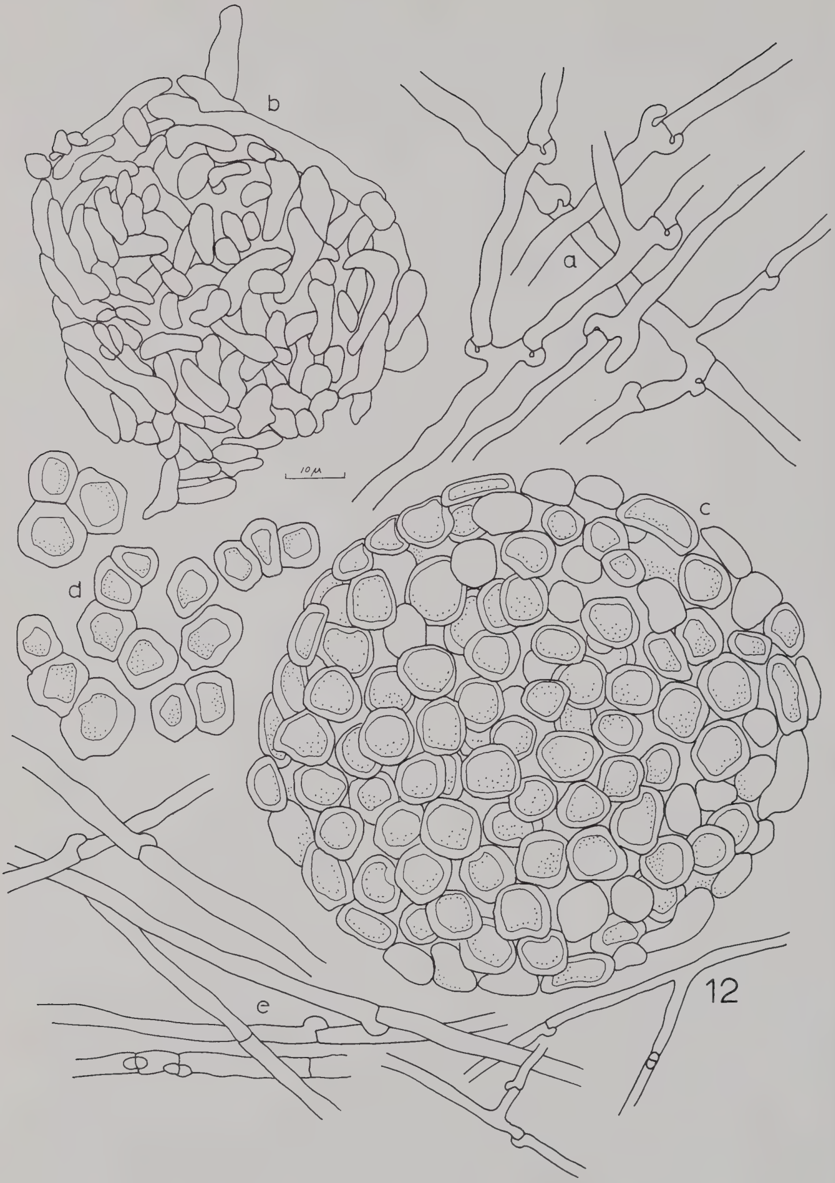


Fig. 12. *Coprinus papagoensis* (vegetative structures, JPL 91 and JPL 403), a, hyphae from advancing zone of culture; b, immature microsclerotium from moist chamber culture; c, mature microsclerotium from moist chamber culture; d, cells from mature microsclerotium; e, hyphae from surface mycelium in field collection.

(Fig. 12c) spherical to ellipsoid, 60-80 µm diam, composed of thick-walled, isodiametric, polyhedral cells (Fig. 12d) 6-12 µm diam; sclerotial bodies on saguaro ribs in the field accompanied by white mycelium and mycelial strands composed of thin-walled hyphae (Fig. 12e) 1.5-4 µm diam, with clamp connections.

Cultures of *C. papagoensis* were readily obtained from microsclerotia and also from tissue from basidiocarps collected on saguaro ribs in the field. Cultures from both sources were identical. They were characterized by a fast-growing, white mycelial mat with concentric zones of sclerotial bodies similar to those found in nature. The hyphae are thin-walled with abundant clamp connections (Fig. 12a). Axenic cultures were also grown on decomposed tissue from the fleshy portion of fallen saguaros and on horse manure. Typical sclerotial bodies developed abundantly on both media. Pieces of saguaro ribs with sclerotial bodies and surface mycelium were placed in moist chambers and incubated at 25 C. Basidiocarps developed in most of these chambers within 2 weeks. Basidiocarp primordia often failed to mature in moist chambers.

Coprinus asterophorus Long et Miller (holotype W. H. Long 9354, UC) was described from desert habitats in New Mexico and Arizona. However, it is not associated with sclerotia and has regularly ellipsoid basidiospores. No other species of *Coprinus* are reported associated with sclerotia like those of *C. papagoensis*. The shape of the basidiospores is also a distinctive character.

Voucher specimens: JPL 91, 92, 98, Saguaro Nat. Monument, West unit, Pima County, AZ; JPL 95 and 97 (HOLOTYPE, BPI), Saguaro Nat. Monument, West unit, Pima County, AZ; RLG 10815, 10840, Saguaro Nat. Monument, West unit, Pima County, AZ; JPL 115 and RLG 10879, 4 mi no. of Gu Komelik, Papago Indian Res., Pinal County, AZ (ARIZ). Collections JPL 95 and 97 include both sclerotial stage and basidiocarps. All other collections contain sclerotial stages only.

NIDULARIA GRISEOLAZULINA Lindsey et Gilbertson, sp. nov.

Fructificatio hemisphaerica, in ligno partim incluso, usque ad 5 mm diam, griseo-lazulinascens; peridium fragili, rumpens, tenue; peridiola polyedrica, griseo-lazulina, 0.5-

1 mm diam, dura; hyphae fibulatae, tunicis crassis vel tenuis; basidiosporae hyalinae, non amyloideae, laeves, ellipsoideae vel ovoideae, 14-18 x 10-14 µm. HOLOTYPUS: in ligno *Carnegiea gigantea* (Engelm.) Britt. et Rose, prope Gu Komelik, Papago Indian Reservation, Pinal County, AZ, U.S.A.; leg. J. P. Lindsey no. 116; in herb. Nat. Fungus Collections, Beltsville, MD, U.S.A. (BPI).

Basidiocarps partially sunken in woody tissue of fallen saguaro ribs, hemispherical, up to 5 mm diam, at first covered with loose, floccose surface mycelium, which also grows over the substratum, this wearing away to expose areas of pale bluish-gray peridium; peridium breaking and fragmenting readily to expose pale bluish-gray inner tissue and a compact mass of peridioles completely filling cavity of basidiocarp; peridioles polyhedral with flat faces adjacent to each other, 0.5-1 mm diam, pale bluish-gray surface appearing pruinose or finely farinaceous; sterile, hard outer layer of peridioles up to 320 µm thick, composed of two zones, outer zone dark bluish in section, 150-220 µm thick, composed of slender, thick-walled, loosely arranged hyphae, 2-4 µm in diam, imbedded in a dark, amorphous material; inner zone hyaline, compact, 70-120 µm thick, composed of thick-walled, almost solid hyphae (Fig. 13b and 13d) these little or much branched, with occasional clamp connections or simple septa, breaking up into short fragments, 6-12 µm in diam; pale inner tissue composed of hyphae of two types, some frequently branched (Fig. 13a) moderately thick-walled, 2.5-5 µm in diam, with abundant clamp connections, others not branched (Fig. 13c), appearing solid, usually lightly incrusted, 1.5-2.5 µm diam, without clamp connections, basidia not seen; basidiospores (Fig. 13e) ellipsoid to ovoid, hyaline, negative in Melzer's reagent, thick-walled, with an apical pore, 14-18 x 10-14 µm.

Other North American species of *Nidularia* have much smaller basidiospores, and also differ in macroscopic characters (White, 1902).

Voucher specimen: JPL 116, on ribs of fallen saguaro, 4 mi north of Gu Komelik, Santa Rosa Valley, Papago Indian Reservation, Pinal County, AZ (HOLOTYPE, BPI).

ACKNOWLEDGMENTS

This research was supported by funds from McIntire-Stennis Project 2016-4166-23. The cooperation of National Park Service personnel at the Saguaro National Monument is also gratefully acknowledged.

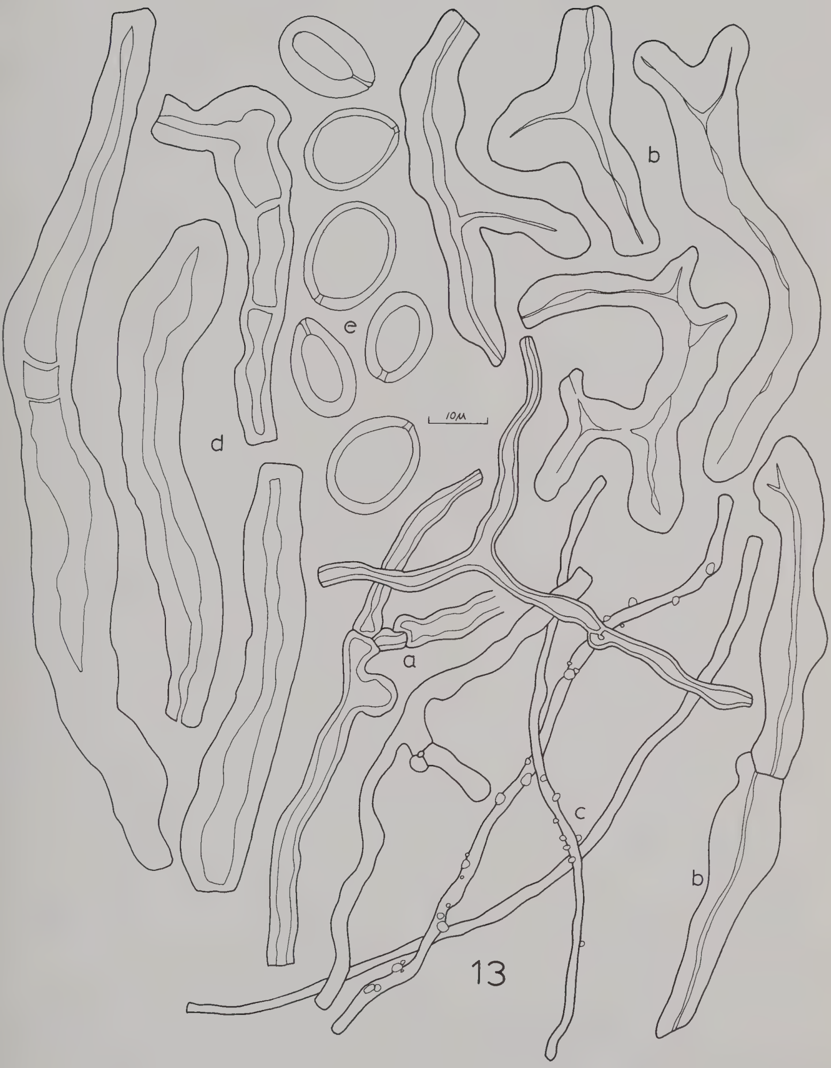


Fig. 13. *Nidularia griseolazulina* (JPL 116), a, slender thick-walled hyphae from interior of peridiole; b, thick-walled hyphae with thread-like lumen from inner layer of peridiole; c, thick-walled, rarely branched hyphae from interior of peridiole; d, thick-walled hyphae from dark outer layer of peridiole; e, basidiospores.

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MYCOTAXON

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A NOTE ON EXTRAWETTSTEININA

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Shortly after publication of preliminary studies on the Dothideales (Barr 1972), Dr. von Arx (in litt.) brought to my attention an earlier generic name for my new genus *Extrawettsteinina*. This note acknowledges the validity of Dr. von Arx's observation that *Kriegeriella* von Höhnel is an earlier name for the species which I assigned to *Extrawettsteinina*.

In 1918 von Höhnel described *Kriegeriella* as a genus of the Microthyriaceae. Batista (1959) re-examined the type specimens of the two original species of *Kriegeriella* -- *K. mirabilis* and *K. transiens* -- and assigned them to the subfamily Aulographoideae Bat. of the Microthyriaceae. Luttrell (1973) placed *Kriegeriella* in the family Asterinaceae of the Hemisphaeriales. Members of this family, he observed, appear to be hemisphaeriaceous counterparts of the Dothioraceae in the Dothideales. It is my opinion that the Dothideales can accommodate fungi with dimidiate-scutate ascocarps as well as those with perithecioid ascocarps. For this reason, *Kriegeriella* is considered here to belong in the Dothideales. By virtue of the interthecial tissue in the locule *Kriegeriella* belongs in my interpretation of the family Pseudosphaeriaceae.

Both of the original species of *Kriegeriella* were described from rotting needles of conifers. Von Höhnel (1918) observed that they were closely related and that *K. transiens* was perhaps only a growth form of *K. mirabilis*. The original description indicated that *K. transiens* had shorter ascocarps, more numerous asci and smaller ascospores with fewer septa (3-4 vs. 5) than *K. mirabilis*. Batista's (1959) description and illustrations do not provide any valid specific difference between the two. The

North American specimens described as *Extrawettsteinina pinastri* include all of the minor variations between *K. mirabilis* and *K. transiens* and only a single species can be recognized. The other two species which I had included in *Extrawettsteinina* are certainly congeneric with *K. mirabilis*. However, ascospore shape and position of the primary septum deviate, much as these characters vary in *Wettsteinina*. Sectional status is accorded these characters in *Kriegeriella*, in conformity with my treatment of *Wettsteinina*.

Kriegeriella von Höhnel, Ann. Mycol. 16: 39. 1918.

Syn.: *Extrawettsteinina* Barr, Contr. Univ. Mich. Herb. 9: 538. 1972.

Section *Kriegeriella*

Ascospores asymmetric in shape, primary septum supramedian.

Type species: *Kriegeriella mirabilis* von Höhnel, Ann. Mycol. 16: 39. 1918.

Syn.: *Kriegeriella transiens* von Höhnel, Ann. Mycol. 16: 40. 1918.

Extrawettsteinina pinastri Barr, Contr. Univ. Mich. Herb. 9: 538. 1972.

Section *Extrawettsteinina* (Barr) Barr, status nov.

Basionym: *Extrawettsteinina* Barr, Contr. Univ. Mich. Herb. 9: 538. 1972.

Ascospores symmetric in shape, primary septum median.

Type species: *Kriegeriella minuta* (Barr) Barr, comb. nov.

Basionym: *Extrawettsteinina minuta* Barr, Contr. Univ. Mich. Herb. 9: 538. 1972.

Second species: *Kriegeriella mediterranea* (Müller) Barr, comb. nov.

Basionym: *Wettsteinina mediterranea* Müller, Sydowia 18: 92. 1965 ("1964").

Syn.: *Extrawettsteinina mediterranea* (Müller) Barr, Contr. Univ. Mich. Herb. 9: 538. 1972.

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The combinations of *Kriegriella minuta* (Barr) von Arx & Müller and *K. mediterranea* (Müller) von Arx & Müller were published in Studies in Mycology, No. 9: 88. March 1975.

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A NEW SPECIES OF STACHYBOTRYS

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SUMMARY

Stachybotrys indica Misra, a new species isolated from decaying leaves, is described and illustrated.

During a taxonomic study of the dematiaceous hyphomycetes of Gorakhpur (India), an unusual species of *Stachybotrys* Corda was collected on very decomposed leaf fragments lying on the surface of soil. The fungus was readily isolated in pure culture and was found to differ from the described species of *Stachybotrys* (Verona and Mazzuchetti, 1968; Ellis, 1971) in the size and shape of conidia and phialides. It is described here as a new species.

Stachybotrys indica *sp. nov. (Fig. 1)*

Coloniae in agaro cum liquore maltoso composito cultae primo albae, conidiis maturescentibus griseo-nigrae, velutinae. Mycelium et superficiale et immersum, e hyphis ramosis, hyalinis, levibus, 0.7 - 1.0 μ crassis compositum. Conidiophora e hyphis aeriis orta, hyalina, levia haud vel raro ramosa, recta vel flexuosa, septata, 40 - 200 μ longa, 1.7 - -2.4 μ crassa, ad apicem coronam ex 4 - 15 phialididibus compositam sustinentia. Phialides hyalinae, leves, 8.2 - 11.7 μ longae, 2.3 - 3.0 μ in parte latissima crassae. Conidia claviformia, ellipsoidalia vel ovoidea, ad apicem rotundata, ad basim truncata, levia, matura griseo-brunnea, 5.2 - 7.0 x 3.0 -3.5 μ , super phialides in capitulo globoso nigro ad 40 μ diametro congesta.

Typus e foliis putrescentibus Gorakhpur Indiae lectis mense October 1972.

Colonies on malt extract agar 3 - 4 cm in diameter in 10 days at 25° C, white, later turning greyish black with the formation of conidia, velvety. Mycelium superficial and immersed, composed of branched, hyaline, smooth, 0.7 - 1.0 μ thick hyphae. Conidiophores arising from aerial hyphae, hyaline, smooth, unbranched or rarely branched, straight or flexuous, septate, 40 - 200 μ long, 1.7 - 2.4 μ thick, bearing at their apex a crown of 4 - 15 phialides. Phialides hyaline, smooth, 8.2 - 11.7 μ long, 2.3 - 3.0 μ thick in the broadest part. Conidia clavate, ellipsoidal or obovoid, rounded at the apex, truncate at the base, smooth, greyish brown when mature, 5.2 - 7.0 x 3.0 - 3.5 μ , accumulating above the phialides into a black globose head of up to 40 μ in diameter.

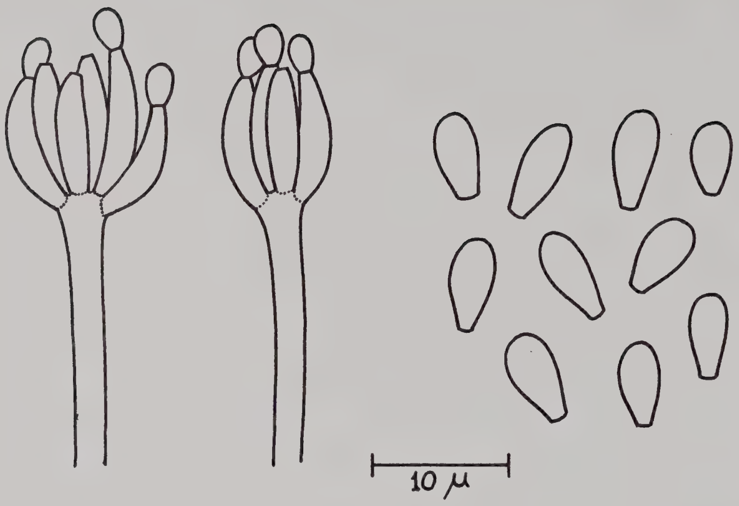

Fig. 1. *Stachybotrys indica.* Conidiophores and conidia.

Type: PCM 550, isolated from decaying leaves, Gorakhpur, U.P., India, October, 1972. A subculture of the type has been deposited in the Commonwealth Mycological Institute, Kew, as IMI 183392.

ACKNOWLEDGEMENTS

The author wishes to thank Dr. M. B. Ellis for examining the fungus and giving helpful suggestions, Prof. K. S. Bhargava for encouragement and facilities, and Dr. Donald P. Rogers for the Latin translation of the diagnosis.

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GENERIC SYNONYMS IN THE TUBERALES

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SUMMARY

Generic synonyms are designated for the Tuberales: *Caulocarpa* = *Sarcosphaera* (Pezizales), *Hydnoplicata* = *Peziza* (Pezizales), *Geoporella* and *Gyrocratera* = *Hydnotrya*, *Piersonia* = *Choiromyces*, *Myrmecocystis* = *Genabea*. *Hydnotryopsis* is regarded as distinct from *Choiromyces* by virtue of having amyloid asci and ellipsoid spores. Recombinations are proposed: *Peziza whitei* (Gilkey) Trappe from *Hydnoplicata*; *Hydnotrya michaelis* (Fischer) Trappe from *Geopora*; *Choiromyces alveolatus* (Harkn.) Trappe from *Piersonia*; *Hydnotryopsis compacta* (Gilkey) Trappe from *Choiromyces*; *Genabea cerebriformis* (Harkn.) Trappe and *G. spinospora* (Gilkey) Trappe from *Myrmecocystis*; and *Hydnocystis japonica* (Kobayasi) Trappe from *Protogenea*. Generic synonyms proposed earlier and confirmed in studies reported here are listed.

The hypogeous macromycetes are relatively little known, because few mycologists know how to collect them and even fewer are well acquainted with the orders on a worldwide basis. Partly as a result, several new and seemingly novel genera have been described from single or only a few collections in various parts of the world. The Tuberales in particular includes several small or monotypic genera. As a polyphyletic and recently evolved order, it might be expected to contain a disproportionate array of small and divergent elements. Nonetheless, the existence of so many small genera should excite a quest for their affinities with other, better known groups. My conclusions from a decade of research on the taxonomy of the Tuberales are presented here.

Herbarium abbreviations are according to Lanjouw and Stafleu (1964). New combinations are indicated by a marginal asterisk.

CAULOCARPA = SARCOSPHAERA (PEZIZALES)

The monotypic genus *Caulocarpa* was described from a single collection by Gilkey (1947) with *C. montana* Gilkey as the type species. Gilkey's superb illustrations of the type material plus my study of the type (Gilkey 284, OSC) as preserved in a glycerol-ethanol solution revealed a strong affinity to the pezizaceous genus *Sarcosphaera*. It differed from *Sarcosphaera* only in its chambered, hypogeous habit and in having nonamyloid asci. I visited the exact type locality in eastern Oregon as described to me by Dr. Gilkey, 30 years to the week after the original collection by A. M. and D. P. Rogers. *C. montana* was fruiting hypogeously in abundance under a felted litter layer in subalpine groves of conifers. Most specimens conformed nicely to Gilkey's description of *Caulocarpa* (fig. 1); some, however, had opened in the typical fashion of *Sarcosphaera crassa* (Santi ex Steud.) Pouzar. Even the closed ascocarps were often mature and would forcibly discharge their spores when broken open. These fresh specimens (Trappe 1933, OSC) had amyloid asci and were clearly *S. crassa* which had simply not emerged and often not opened due to habitat factors. Subsequently, some dried-out, temporary microscope mounts made by Dr. Gilkey from the type collection when it was fresh were discovered in her slide collection. The asci of these were beautifully amyloid; the long immersion in glycerol-ethanol of the type itself had destroyed the reaction. *C. montana* thus can be added to the long list of synonyms of *S. crassa*.

HYDNOPLICATA = PEZIZA (PEZIZALES)

Hydnoplicata whitei Gilkey was described as the type species of a monotypic new genus known only from a single collection from Australia (Gilkey 1954a). The type has strongly amyloid, demonstrably operculate asci. Its spores are 10.5-14x8-11µm rather than 10-11x6.5-8µm as described by Gilkey. It is, in fact, identical in all details to *Hydnocystis convoluta* McAlpine, the type of which has been studied by both me and Burdsall (1968). Burdsall and Korf

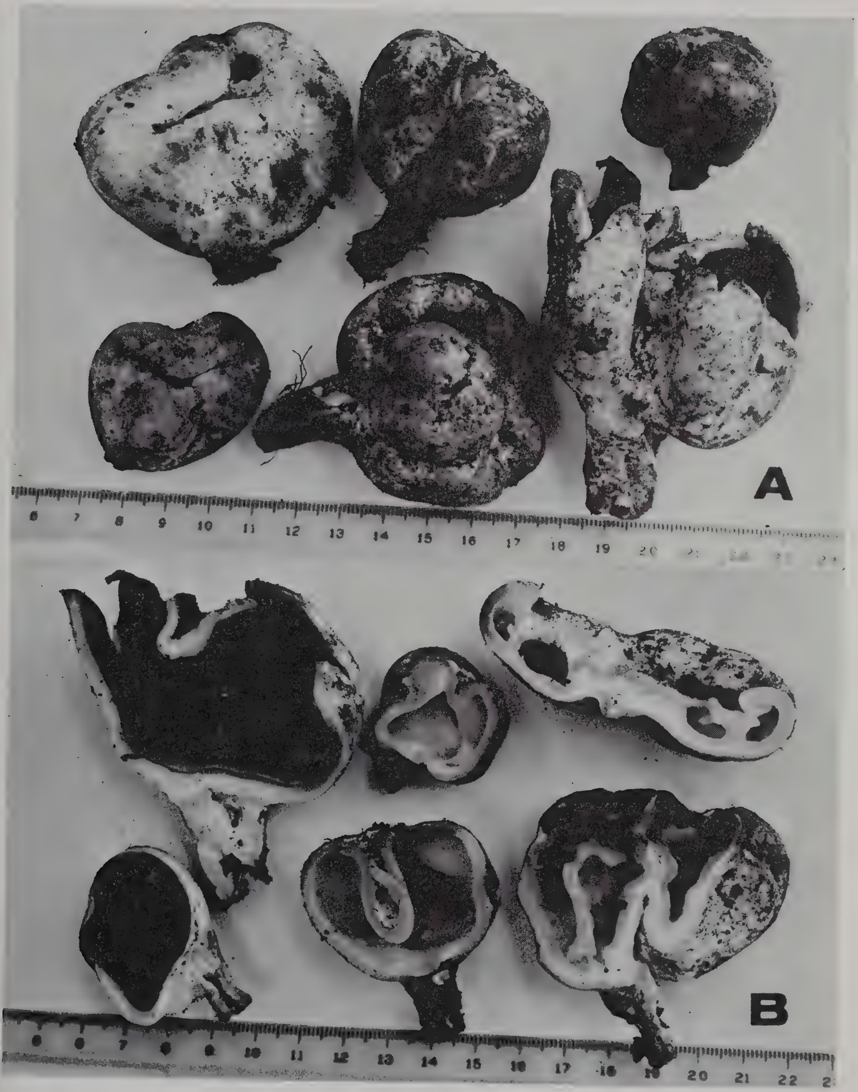
A
6 7 8 9 10 11 12 13 14 15 16 17 18 19
B
6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22

Figure 1. Hypogeous ascocarps of *Sarcosphaera crassa* (scale in mm). A. Intact. B. Sliced in half vertically.

transferred *H. convoluta* to *Peziza* for cogent reasons later elaborated by Korf (1973a). To avoid creating a homonym, their transfer required a new species epithet, *P. jactata* Burds. and Korf. Since *Hydnoplicata whitei* is conspecific, however, the epithet *whitei* has priority.

**PEZIZA WHITEI* (Gilkey) Trappe comb. nov.
≡ *Hydnoplicata whitei* Gilkey, Mycologia 46: 784. 1954. (Type: Gilkey 540, OSC.)

= *Hydnocystis convoluta* McAlpine, Agric. Gaz. N. S. W. 7: 86. 1896. (Type: Rodway 21, K.)

≡ *Hydnotrya convoluta* (McAlpine) McLennan, Proc. R. Soc. Victoria N. S. 74: 115. 1961.

≡ *Peziza jactata* Burdsall and Korf in Burdsall, Mycologia 60: 520. 1968.

The consolidation of these taxa into one species extends its range from Tasmania to mainland Australia. I have examined these collections: NEW SOUTH WALES--Sydney, leg. N. H. White, Gilkey 540 (type of *Hydnoplicata whitei*, OSC); Blue Mountains, leg. B. Menzies, 1958, Gilkey 926 (OSC). QUEENSLAND--Lamington National Park, leg. J. Cribb, 3 July 1951, Gilkey 857 (OSC). TASMANIA--near Hobart: Rodway 21, 1895, type of *Hydnocystis convoluta* (K); leg. Rodway, undated, Lloyd 7238 (BPI). National Park: leg. Rodway, June 1924 (HO).

GEOPORELLA AND GYROCRATERA = HYDNOTRYA

Soehner (1951) erected the genus *Geoporella* to accommodate two species, *G. michaelis* (Fischer) Soehn. and *G. suevica* (Soehn.) Soehn. My study of the type of *G. suevica (Hydnotryopsis suevica* Soehn., Soehner 1541, M) led to the conclusion that it is a taxonomic synonym of *Hydnotrya cerebriformis* Harkn. The history of *G. michaelis* is rather more complex. In brief, the species has been described under several generic and species names from several places, apparently because its considerable variability in size and form was not recognized for the infraspecific variation that it actually represented. Such variability is common in *Hydnotrya*, as discussed by Gilkey (1947) for *H. variiformis* Gilkey and by Hawker (1974) for *H. tulasnei* Berk. and Br. Hawker commendably synonymized *Gyrocratera* with *Hydnotrya*. The resulting synonymies listed below were determined by examination of types or isotypes except in the case of *Hydnotrya dysodes* Kirschstein, the type of which was apparently destroyed in World War II. It was, however, studied by Soehner (1942), who regarded it as unquestionably conspecific with *G. michaelis*.

HYDNOTRYA Berk. and Br., Ann. Mag. Nat. Hist. 18: 78. 1846.

= *Gyrocratera* Hennings, Verh. Bot. Ver. Prov. Brandenburg 41: IX. 1899.

= *Geoporella* Soehner, Z. Pilzk. 8: 8. 1951.

**HYDNOTRYA MICHAELIS* (Fischer) Trappe comb. nov.

≡ *Geopora michaelis* Fischer, Hedwigia 37: 57-59. 1898. (Type: E. Michael, Auerbach, TO.)

≡ *Hydnotryopsis michaelis* (Fischer) Soehner, Notizbl. Bot. Gart. Mus. Berlin-Dahlem 15: 771. 1942.

≡ *Geoporella michaelis* (Fischer) Soehner, Z. Pilzk. 8:8. 1951.

= *Gyrocratera ploettneriana* Henn., Verh. Bot. Ver. Prov. Brandenburg 41: IX. 1899. (Type: Rathenau, Mark, leg. Ploettner, BERN.)

≡ *Hydnotrya ploettneriana* (Henn.) Hawker, Trans. Br. Mycol. Soc. 63: 68. 1974.

= *Gyrocratera ploettneriana* var. *sabuletorum* Ramsbottom in Fischer, Mitt. Naturforsch. Ges. Bern 1926: 112. 1927. (Type: Sandy, Bedford, leg. E.J.H. Corner, 16 May 1926, K; isotype, BERN.)

= *Hydnotrya dysodes* Kirschstein, Notizbl. Bot. Gart. Mus. Berlin-Dahlem 15: 612. 1941. (Type lost.)

= *Hydnotrya yukonensis* Gilkey, Mycologia 39: 445. 1947. (Type: Gilkey 353, OSC.)

PIERSONIA = CHOIROMYCES

Piersonia was described by Harkness (1899) as a genus with nests of asci dotting the gleba. Fischer (1908) and

Gilkey (1916) subsequently determined that the gleba of *Piersonia* was formed into tramal tissue (*venae internae*) marbled with paraphysis-lined veins (*venae externae*) that terminated in chambers with fertile hymenia. Fischer's (1908, 1938) illustrations, however, show immature asci among paraphyses beyond the fertile terminations of the veins. *Piersonia bispora* Gilkey, moreover, is clearly illustrated by an immature ascus with two mature spores and two immature spores (Gilkey 1916). Gilkey (1954b) later described a good *Choiromyces*, *C. cookei* Gilkey; my study of the types of both *P. bispora* and *C. cookei* revealed that the former was simply an immature specimen of the latter, the veins of which were fertile along their entire lengths as well as at their terminations. Types or isotypes of all species synonymized below have been examined; they were identical in all features except the degree of ascus maturation. It almost seems that when Harkness made a new collection, he was inclined to describe it as a new species if it differed slightly in stages of development from previous collections.

CHOIROMYCES Vitt., Monogr. Tuberacearum, p. 50-51. 1831.

= *Piersonia* Harkn., Proc. Cal. Acad. Sci. ser. 3, 1: 275. 1899.

= *Zobelia* Opiz, Lotos Z. Naturwiss. 5: 218. 1855.

**CHOIROMYCES ALVEOLATUS* (Harkn.) Trappe comb. nov.

≡ *Piersonia alveolata* Harkn., Proc. Cal. Acad. Sci. ser. 3, 1: 275. 1899. (Type: Harkness 183, BPI; isotype, OSC.)

= *Piersonia scabrosa* Harkn., Proc. Cal. Acad. Sci. ser. 3, 1: 275. 1899. (Type: Harkness 201, BPI; isotype, OSC.)

= *Hydnobolites excavatum* Harkn., Proc. Cal. Acad. Sci. ser. 3, 1: 266. 1899. (Type: Harkness 189, BPI; isotype, OSC.)

= *Piersonia bispora* Gilkey, Univ. Cal. Publ. Bot. 6: 328. 1916. (Type: N.L. Gardner, U.C. 126, OSC.)

= *Choiromyces cookei* Gilkey, N. Am. Flora ser. 2, 1:17. 1954. (Type: Gilkey 801, OSC.)

C. alveolatus, an American analog of the southern European *C. magnusii* (Matt.) Paol., has distinctive peridial hyphae with walls thickened in bands to give a beaded appearance.

PROTOGENEA = HYDNOCYSTIS

Kobayasi (1963) contrasted his new genus *Protogenea* with *Hydnocystis* on the basis that sporocarps of the former are epigeous, sometimes have two chambers, have an apical opening, and are not tomentose. His data were drawn from a single collection. However, many hypogeous fungi occasionally fruit on the soil surface, especially if leaf litter has fallen prior to fruiting. Several species of Tuberales are characteristically single chambered but occasionally form two or more chambers, e.g., in *Genea* or *Hydnotrya* subgen. *Gyrocratera*. Burdsall (1968) notes that the sporocarp opening of *Hydnocystis* can be oriented in any direction. My studies of an isotype of *Protogenea japonica* Kobayasi confirm the conclusions of Burdsall and Korf (Korf 1973b) that the sporocarp has abundant hyphal tips emergent from the surface. In fact, *P. japonica* is extremely close to *Hydnocystis piligera* Tul. & Tul. in every character of taxonomic significance at the generic level and in most characters at the species level.

HYDNOCYSTIS Tul. & Tul., G. Bot. Ital. 2 Part 1: 59. 1845.

= *Protogenea* Kobayasi, Trans. Mycol. Soc. Japan 4: 119-120. 1963.

**HYDNOCYSTIS JAPONICA* (Kobayasi) Trappe comb. nov.

≡ *Protogenea japonica* Kobayasi, Trans. Mycol. Soc. Japan 4: 120. 1963. (Type: Japan, Utizume, 12-14 Nov. 1962, TNS; isotype, CUP.)

THE INTEGRITY OF HYDNOTRYOPSIS

The genus *Hydnotryopsis*, erected to accommodate *H. setchellii* Gilkey (Type: Harkness 173, BPI; isotype, OSC) with relatively small, ellipsoid spores (Gilkey 1916), was later synonymized with the globose-spored *Choiromyces* by Gilkey (1939). Unbeknown to Gilkey, *Hydnotryopsis* also proves to have amyloid asci, a feature virtually undetectable on the pickled type collections of its two species but striking on dried or fresh material. Accordingly, Gilkey's first judgment of *Hydnotryopsis* as a separate genus is appropriate. It is, incidentally, the only American genus discovered to date to have amyloid asci. Since the second species was described as a *Choiromyces*, it is recombined here:

**HYDNOTRYOPSIS COMPACTA* (Gilkey) Trappe comb. nov.

≡ *Choiromyces compactus* Gilkey, Oreg. State Monogr. Stud. Bot. 1: 34. 1939. (Type: Gilkey 28, OSC.)

MYRMECOCYSTIS = GENABEA

The case for separating *Myrmecocystis* from *Genea* on the one hand and from *Genabea* on the other is detailed by Gilkey (1954a, 1961). The three genera form a continuum and are said to differ thus:

Genea: Spores ellipsoid, basal mycelial tuft present, fertile hymenium continuous or occasionally interrupted by sterile zones of paraphyses.

Myrmecocystis: Spores globose, basal mycelial tuft lacking, fertile hymenium interrupted by sterile zones of paraphyses.

Genabea: Spores globose or ellipsoid, basal mycelial tuft lacking, hymenium interrupted by sterile zones of pseudoparenchyma.

The distinctions thus drawn between the genera are blurred by the inclusion of two discordant species in *Myrmecocystis*: *M. cerebriformis* Harkn. (the type species) and *M. compacta* (Harkn.) Gilkey. Both species are common in western Oregon, so I have been able to examine fresh collections in all in their phenotypic diversity. Small ascocarps of *M. cerebriformis* tend to be evenly globose, singly chambered, lined with fertile pockets of hymenium separated mostly by sterile zones of paraphyses. Large, well-developed ascocarps, on the other hand, tend to be fused clusters of rounded protuberances, each lined with a fertile hymenial pocket separated from adjacent protuberances by zones of isodiametric cells. The latter form resembles that illustrated for *Genabea* by Fischer (1938, fig. 8). *M. compacta*, on the other hand, is always typically *Genea*-

like in form and structure (as recognized also by Gilkey (1916) who included it in that genus as *G. intermedia* Gilk.).

Strictly from the standpoint of ascocarp structure, all three genera might well be consolidated into *Genea* sensu lato, as suggested by Korf (1973b). Although I regard the genus *Myrmecocystis* as superfluous, the retention of *Genea* and *Genabea* has the merit of spotlighting the phylogenetic progression of *Genea* to *Genabea*. This progression accords with ideas expressed by Trappe (1971) and Korf (1973a) on evolution of the Tuberales. Moreover, synonymization of *Myrmecocystis* with *Genabea* eliminates ambiguities between the genera involved, which can then be readily differentiated:

Genea: spores verrucose, uniseriate; asci cylindric; hymenia only occasionally interrupted by sterile zones of paraphyses.

Genabea: spores echinulate, uniseriate, biseriate or randomly arranged; asci clavate to ellipsoid; hymenia regularly separated into pockets by sterile zones of paraphyses or isodiametric cells.

Species synonyms listed below are based on my examination of the types.

GENEA Vitt., Monogr. Tuberacearium, p. 27. 1831.

= *Hydnocaryon* Wallr., Flora Cryptogam. Ger. 2: 860. 1833.

Genea intermedia Gilkey, Univ. Cal. Publ. Bot. 6: 303. 1916.

≡ *Hydnocystis compacta* Harkn., Proc. Cal. Acad. Sci. ser. 3, 1: 262. 1899. (Type: Harkness 98, BPI; isotype, OSC.) Non *Genea compacta* Harkn., Proc. Cal. Acad. Sci. ser. 3, 1: 262. 1899.

≡ *Myrmecocystis compacta* (Harkn.) Gilkey, N. Am. Flora ser. 2, 1: 7. 1954.

GENEABEA Tul. & Tul., G. Bot. Ital. I, 2: 60. 1845.

= *Myrmecocystis* Harkn., Proc. Cal. Acad. Sci. ser. 3, 1: 269. 1899.

≡ *Genea* subgen. *Myrmecocystis* (Harkn.) Gilkey, Univ. Cal. Publ. Bot. 6: 297. 1916.

= *Pseudogenea* Buch. in Matt., Malpighia 14: 250. 1900.

**GENABEA CEREBRIFORMIS* (Hark.) Trappe comb. nov.

≡ *Myrmecocystis cerebriformis* Harkn., Proc. Cal. Acad. Sci. ser. 3, 1: 269. 1899. (Type: Harkness 25, BPI; isotype, OSC.)

≡ *Genea cerebriformis* (Harkn.) Gilkey, Univ. Cal. Publ. Bot. 6: 304. 1916.

= *Myrmecocystis candida* Harkn., Proc. Cal. Acad. Sci. ser. 3, 1: 269. 1899. (Type: Harkness 18, BPI; isotype,OSC.)

= *Pseudogenea vallombrosae* Buch. in Matt., Malpighia 14: 250. 1900. (Type: Italy, Vallombrosa, 20 June 1900, TO.)

≡ *Pseudogenea vallisumbrosae* Buch., Hedwigia 40: 129-141. 1901.

≡ *Myrmecocystis vallombrosae* (Buch. in Matt.) Fischer, Bot. Ztg. 66: 147. 1908.

= *Pseudogenea californica* Fischer, Ber. Dtsch. Bot. Ges. 25: 372-373. 1907. (Type: U.C. 272, BERN; isotype, OSC.)

**GENABEA SPINOSPORA* (Gilkey) Trappe comb. nov.

≡ *Myrmecocystis spinospora* Gilkey, Mycologia 53: 215. 1961. (Type: CUP 43847; isotype, Gilkey 867, OSC.)

PREVIOUSLY DETERMINED SYNONYMS

Numerous generic synonymies in the Tuberales and Pezizales have been proposed in addition to those discussed above (Fischer 1938; Gilkey 1954b, 1961; Korf 1956; Szemere 1965; Burdsall 1968; Trappe 1971). Studies of type or isotype collections of type species, or of descriptions when such collections have not been located, permit confirmation of these synonymies:

BALSAMIA Vitt., Monogr. Tuberacearum, p. 30, 1831.

= *Pseudobalsamia* Fischer, Ber. Dtsch. Bot. Ges. 25: 374. 1907.

GEOPORA Harkn., Bull. Cal. Acad. Sci. 1: 168. 1885.

= *Sepultaria* (Cooke) Boudier, Bull. Soc. Mycol. Fr. 1: 104. 1885.

= *Pseudohydnotrya* Fischer in Engler & Prantl, Nat. Pflanzenfam. Teil I, 1: 282. 1897.

LESPIAULTINIA Zobel, Corda Icones Fungorum 6: 55-65. 1854.

≡ *Delastreopsis* Matt. Bol. Soc. Broteriana 21: 95-97. 1906.

PACHYPHLOEUS Tul. & Tul., G. Bot. Ital. pt. 2, 1: 60-61. 1845.

≡ *Pachyphlodes* Zobel, Corda Icones Fungorum 6: 63. 1854.

= *Cryptica* Hesse, Pringsheims Jahrb. Wiss. Bot. 15: 198-206. 1884.

PICOA Vitt., Monogr. Tuberacearum, p. 54-55. 1831.

= *Leucangium* Quél., C. R. Assoc. Fr. Av. Sci. 11: 404. 1883.

≡ *Picoa* subgen. *Leucangium* (Quél.) Trappe, Trans. Br. Mycol. Soc. 57: 89. 1971.

= *Phaeangium* Pat., J. Bot. 8: 155. 1894. Non Saccardo, Sylloge Fungorum 16: 764. 1902.

STEPHENSIA Tul. & Tul., C. R. Acad. Sci. Paris 21: 1433. 1845.

= *Densocarpa* Gilkey, N. Am. Flora ser. 2, 1: 15. 1954.

TERFEZIA (Tul. & Tul.) Tul. & Tul., Fungi Hypogaei, p. 172. 1851.

≡ *Choiromyces* subgen. *Terfezia* Tul. & Tul., Ann. Sci. Nat. ser. 3, 3: 350. 1845.

≡ *Tulasneinia* Zobel, Corda Icones Fungorum 6: 64. 1854.

= *Mattirolomyces* Fischer, Engler & Harms Nat. Pflanzenfam. ed. 2, 5b (8): 39. 1938.

≡ *Terfezia* subgen. *Mattirolomyces* (Fischer) Trappe, Trans. Br. Mycol. Soc. 57: 91. 1971.

TUBER Mich. ex Fries, Syst. Mycol. 2: 289. 1823.

≡ *Aschion* Wallr., Flora Cryptogam. Ger. 2: 865. 1833.

= *Ensaluta* Zobel, Corda Icones Fungorum 6: 54. 1854.

= *Oogaster* Corda in Zobel, Corda Icones Fungorum 6: 70. 1854.

= *Tuber* subgen. *Vittadinion* Zobel, Corda Icones Fungorum 6: 75. 1854.

= *Terfeziopsis* Harkn., Proc. Cal. Acad. Sci. ser. 3, 1: 278. 1899.

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BISPORELLA DISCEDENS AND ITS CYSTODENDRON STATE

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On a recent expedition to the island of Guadeloupe, French West Indies, the author had the opportunity to collect specimens of *Calycella discedens* (Karst.) Dennis. This fungus was first described from Brazil as *Helotium discedens* by Karsten (1889). It is widespread in the American tropics, and known from the Asian tropics and Europe.

Seaver (1924) redescribed the same organism as *Niptera subiculata* Seaver from St. Thomas. Rick (1931) also described the same fungus as new, as *Trichopeziza aurea* Rick from Brazil. Since the anatomical structure of the apothecia of *H. discedens* and *N. subiculata* agreed with the then current concept of *Calycella*, Dennis (1954) made the combination *Calycella discedens* (Karst.) Dennis. He stated that the only difference between Karsten's type and Seaver's type was the presence of septate ascospores in *N. subiculata* in contrast to the non-septate ascospores in Karsten's material.

Since there seemed to be some question as to the identity of *H. discedens* and *N. subiculata*, this author turned to Karsten's herbarium in order to compare the type collection of *H. discedens* with that of *N. subiculata*. Presently, there are two collections of *H. discedens* in Karsten's herbarium. One is labelled "no 1268 *Helotium discedens* Karst. BRASILIA. Minas Geraes, Sitio 1885 leg. Edw. Wainio," the other "no 1267 *Helotium discedens* Karst. BRASILIA. Minas Geraes, Sitio leg. Edw. Wainio." The only difference between the labels of these two collections is the citation of the date "1885" in #1268, which is absent in #1267. In collection #1267 there are large yellowish apothecia growing on wood amongst a dense growth of crustose and fruticose lichens. The apothecia in this collection are immature. In collection #1268 I found numerous apothecia, somewhat smaller than those in the other collection, scattered over bare wood. The apothecia in this collection are fully mature, with a gelatinized ectal excipulum and 1-septate ascospores. Dennis (1954) stated that he could find no septate ascospores in the type collection, and it is possible that he only examined #1267; no annotation labels were found with the specimens.

Since Karsten (1889) did not designate a holotype, and the two specimens in his herbarium bear almost the same collection data, a lectotype must be designated. Therefore, I select specimen #1268, deposited at the University of

Helsinki (H), as lectotype specimen for *Helotium discedens* Karst.

Examination of the isotype specimen of *Niptera subiculata*, deposited at Cornell University (CUP), showed that both it and the Guadeloupe specimens are identical to Karsten's *H. discedens*. As Dennis (1954) indicated, there is no true subiculum in Seaver's collection. The blackening of the substrate is due to both the presence of Pyrenomycetes and numerous dematiaceous Hyphomycetes covering the surface of the wood. Korf and Carpenter (1974) have indicated that this genus of Discomycetes is often associated with other fungi.

A search for tropical collections of *Calycella* in the CUP herbarium revealed that a portion of a presumed isotype specimen of *Trichopeziza aurea* Rick from the Farlow Herbarium (FH) had been identified as a *Calycella* by Dr. J. R. Dixon. It is identical to Karsten's *H. discedens*. His annotation label reads: "This is the same as *Coryne flavovirens* (Pers. ex Fr.) Rehm, Ascomycetes Exsiccatae No.1109, 1895 which is to me a *Calycella*. One interested in this fungus should also see *Calycella callorioides* (Rehm) Boud. in Ic. Myc. ser. 6:11. 1909." Examination of two packets of Rehm's exsiccatum in the CUP herbarium revealed that his specimens are also identical to *H. discedens*. This collection from Zürich is the only temperate collection known to me. A discussion of the nomenclature of *Coryne flavovirens* was given by Korf (1974), who showed it to be a *Vibrissea*. Examination of the holotype of *Calycella callorioides* from Stockholm (S) revealed that although the ascospores are similar to those of *H. discedens*, the apothecial structure is that of a *Hymenoscyphus*.

Korf and Carpenter (1974) have indicated that the generic name *Bisporella* Fuckel must be used for those species previously placed in *Calycella*. Thus, it is necessary to transfer *C. discedens* to the genus *Bisporella*:

Bisporella discedens (Karst.) Carpenter, *comb. nov.*

≡ *Helotium discedens* Karst., Hedwigia 28: 191, 1889.
≡ *Calycella discedens* (Karst.) Dennis, Kew Bull. 1954: 320, 1954.
= *Niptera subiculata* Seaver, Mycologia 16: 8, 1924.
= *Trichopeziza aurea* Rick, Brotéria, Sér. Bot. 25: 103, 1931.

From a study of a number of specimens from the Neotropics, it is apparent that *B. discedens* is a fairly common Discomycete, often mistaken by collectors for a small *Mollisia* or *Orbilia*. Most collections of this fungus have been made in late June through July, although the Guadeloupe collections were made early in January. *Bisporella discedens* fruits on various kinds of wood (usually unidentified) and has been reported on *Piper*, *Rubus* and palms.

There is a great variability in both size and coloration of the apothecia of *B. discedens*. The color ranges from almost completely white, to bright yellow and sometimes tan. The apothecial diameter ranges from 0.5 to 2.0 mm, and the apothecia may be sessile to strongly stipitate.

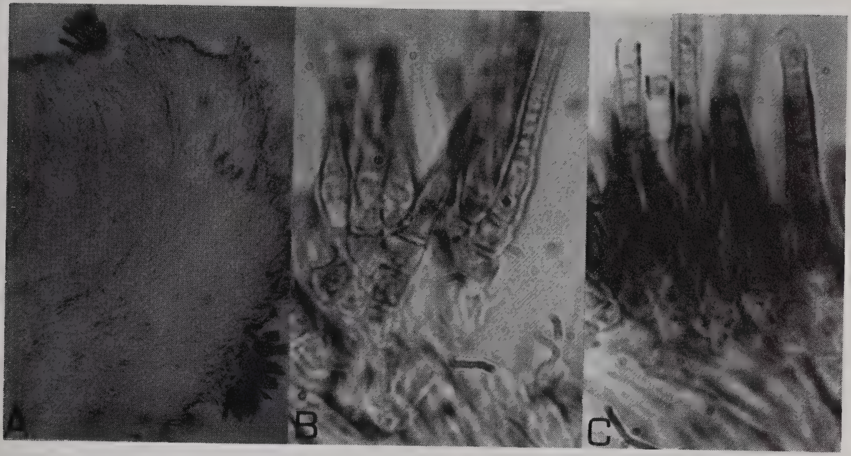
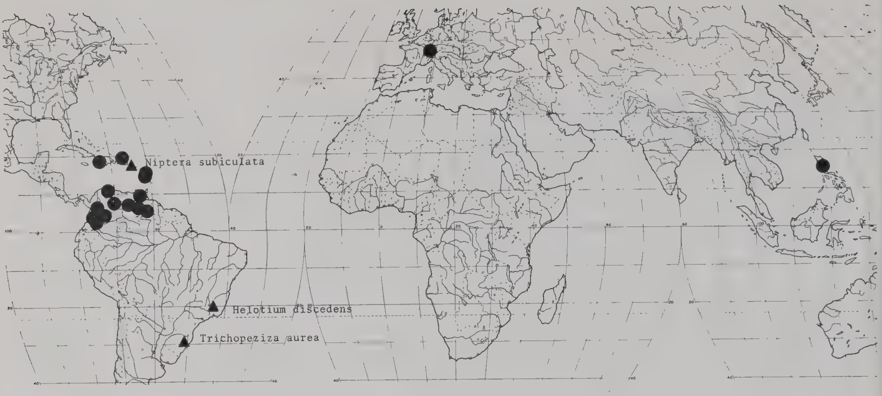


FIG. 1. Photomicrographs of *Cystodendron* state of *Bisporella discedens*, Dumont-VE 1120 (NY). A. Phialides arising near the paraphysis apices at the margin of and along the flanks of an apothecium, × 250. B. Branching phialide bases, × 1550. C. Phialides and phialospores, × 1550.

The ectal excipulum of the apothecium is composed of interwoven gelatinized hyphae, forming a highly refractive tissue as viewed in bright-field microscopy. The ascospores are 1-septate, with one to two guttules in each cell, fusiform, hyaline, and (6.0-) 8-10 (-11) × (1.0-) 1.5-2.0 (-2.5) µm. Asci are 65-75 × 5-6 µm and J-. Paraphyses are cylindrical, septate, slightly wider than 1.0 µm at the tip and tapering to slightly less than 1.0 µm near the base, extending 8.0-10.0 µm above the asci.

I have found an imperfect state, which should probably be assigned to the genus *Cystodendron* Bubák (although affinities with *Chalara* (Corda) Rabenh. should not be overlooked), often associated with the apothecia of this fungus (Fig. 1). The brown phialides arise from a series of angular, branching, hyaline cells which are 2.5-3.0 µm across. These cells appear to have their origin in the excipular tissues, although I have been unable to trace them completely. The phialides are 20-25 × 2.0 µm, with a slightly bulbous base. Phialides occur in clusters of 3 to 15. The conidia are hyaline, 2-2.5 × 2.0 µm, usually rectangular but sometimes spherical. The clusters of phialides are visible with a 10× hand lens and appear as a brownish fringe covering the outer surface of the apothecia. The phialides are also responsible for the tan coloration of the apothecia in some collections. I will refrain from naming the *Cystodendron* state until cultural work can be undertaken.



KNOWN DISTRIBUTION of *Bisporella discedens*. Type localities marked with with triangles, other localities marked with circles.

SPECIMENS EXAMINED: Those specimens with the *Cystodendron* state observed are denoted with an asterisk (*). BRAZIL: Lectotype specimen of *Helotium discedens*, Karsten 1268 (H); Karsten 1267 (H); *Presumed Isotype specimen of *Trichopeziza aurea*, Rick, São Leopoldo, Rio Grande do Sul, 1929 (FH, = CUP 52695). COLOMBIA: Dumont-CO-13, 39, *231, 452, 1113, 1238, 1387, *1590, 1597, 1667, 1683, 1831, 1934, 1949 (all at NY). DOMINICA: *CUP-DO-15, 25, *200. GUADELOUPE: D.H. Pfister 1040 et al. (FH); Pfister 1066a et al. (FH). HAITI: CUP-HA 12. PHILIPPINES: CUP-SA 783, *848. PUERTO RICO: *CUP-PR-4164, *4183; A.Y. Rossman 194 (= OSC-28951). ST. THOMAS, V.I.: Isotype specimen of *Niptera subiculata*, CUP-WI-829. SWITZERLAND: Rehm, Ascomycetes Exsiccatae 1109, sub *Coryne flavovirens* (ex FH = *CUP-52694, *CUP-D-8544). VENEZUELA: Dumont-VE-35, 49, 116, 155, 162, 244, 250, 363, 578, *780, 913, 967, 1027, 1033, 1045, 1046, *1047, *1099, *1114, *1120, 1125, *1127, *1136, 1276, 1481, 1624, 1735, 1766, 1860, 2010, 2105, 2119, 2157, 2396, 2439, 2614, 2786, 2821, 2825, 2977, 3221, 3246, 3302, 3314, 3329, 3432, *3562, *3563, *3589, 3591, 3755, *3759, 5007, 5335, 5834, 5852, 5870, 6198, 6277, 6376, 6426 (all at NY).

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A NEW DORATOMYCES FROM WATERHYACINTH[1]

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A project to survey fungi associated with waterhyacinth, Eichhornia crassipes, was begun in November 1973. The purpose of this project was to find organisms that could be utilized as biocontrols of the prolific waterhyacinth. In February 1974, in a collection of decaying waterhyacinth laminae many light-buff colored synnemata were noted. As far as we know, this is the first report of a synnematal fungus occurring on waterhyacinth. Pathogenicity studies on waterhyacinth indicated that the organism was a saprophyte. The conidiogenous cells appeared to be phialides but closer examination revealed annellations on which conidia are held in a dry loose head. The organism was assigned to the genus Doratomyces Corda sensu Morton and Smith (1963).

There is a controversy concerning the correct name to apply to our organism. In 1797, the type specimen of the genus was originally called Isaria stemonitis by Persoon. Later, in 1801 Persoon reevaluated this specimen and transferred the organism to Periconia. In 1809, Link established the genus Cephalotrichum with C. rigescens as type and transferred P. stemonitis to the genus Cephalotrichum with no description. Hughes (1958), while proposing the observation of 1801 as the starting point for Hyphomycete nomenclature, adopted Cephalotrichum Link with C. stemonitis (Pers.) Link as the lectotype. No specimen of C. rigescens has been found or is known to exist. If C. rigescens is a nomen dubium the genus Cephalotrichum Link ex Fr. based on that species is also nomen dubium. Fries (1832) while accepting the genus Cephalotrichum stated that Doratomyces neesii Corda (1829) was an aging specimen of C. stemonitis.

Morton and Smith (1963) challenged the typification of Cephalotrichum Link ex Fr. by C. stemonitis (as lectotype) because they felt that Links description of C. rigescens was of a group that was not congeneric with Periconia

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[1] Florida Agricultural Experiment Station No. 5834.

stemonitis. They agreed with Fries that the type specimen of *Doratomyces* was the same species as *C. stemonitis* and adopted *Doratomyces* Corda for *D. stemonitis* (Pers. ex Fr.) Morton and Smith.

Barron (1972) used the name *Doratomyces* but recognized the need for further clarification. Kendrick and Carmichael (1973) recognized *Cephalotrichum* as the valid name. There have been no further reports on the genus. Therefore, we agree with Morton and Smith and the arguments of Weresub and Pirozynski (Pers. Comm.) in recognizing *Doratomyces* as the valid name for the genus.

In Morton and Smith's monograph the species that most clearly corresponds to the organism considered herein is *D. putredinis*. This relationship is based on the light-buff coloration of the synnemata. Both organisms differ from other species of *Doratomyces* by their lack of dematiaceous coloration. In studies utilizing a variety of media, colony coloration could be varied; however, the synnmata of our fungus retained their light-buff color.

Colonies on oatmeal agar at 25 C grew slowly and attained a diameter of 34 mm in 3 weeks. The mycelium was at first light-buff turning later to cocoa[1] (Plate 7, A-10). The colony became funiculose with the synnemata forming at irregular intervals. The reverse coloration was a light purple-brown (Rose ebony, Plate 8, E-6).

Colonies on potato dextrose agar plus yeast extract at 25 C attained the greatest diameter (45 mm) in 3 weeks. Colonies were light-buff later turning a light brown (Golden brown, Plate 14, F-12) with a dark brown exudate. Synnemata were not formed as abundantly as on oatmeal agar. The reverse coloration was a dark purple-brown.

Colonies on potato dextrose agar and cornmeal-malt extract-yeast extract agar at 25 C were slow growing, 29 mm and 25 mm, respectively. Colony colorations were light-buff. Synnemata were rarely produced on either medium.

A comparison of our organism with *D. putredinis* (Morton and Smith, 1963) leads us to believe that existing differences warrant establishment of a new species (Table I).

Doratomyces eichhornius sp. nov. (Figs. 1-4).

Myceliales hyphae hyalinae plerumque superficiales; synnemata in greges conferta, cum conidiophoris 120-800 μ longa, cum apice expanso simili soluti capitis; annellophora 15-25 X 4-5 μ timidula in base et paulatim attenuata ad zonam annellatam; conidium primum ovatum cum altero ex extremis truncato;

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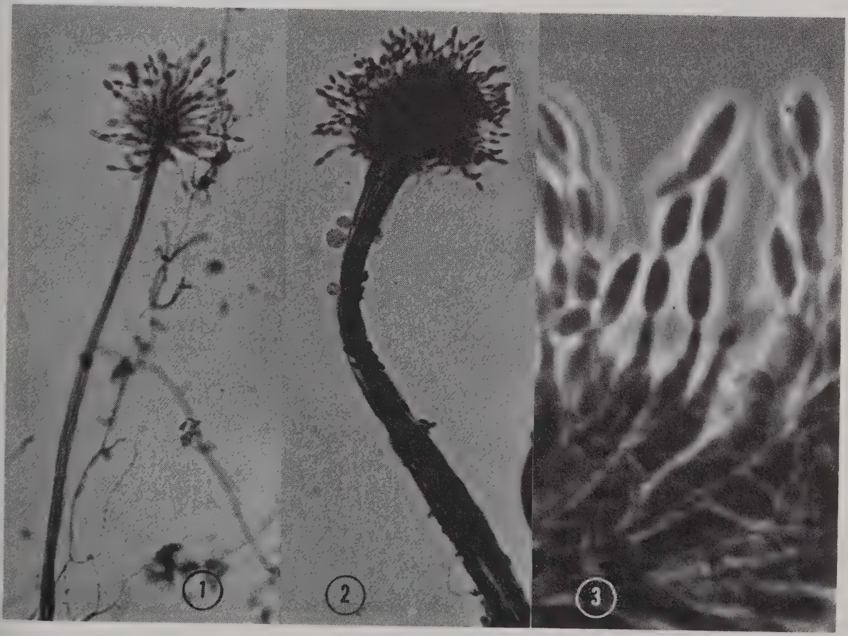
[1] Color designations are taken from Maerz and Paul (1930).

TABLE I

A comparison of measurements of
D. putredinis and D. eichhornius

	D. putredinis	D. eichhornius
Conidium size	4.5-6 X 2-3 μ	7-9 X 3.5-5 μ
Conidium ornamentation	smooth	minutely verrucose
Length of annellophores	6-20 X 2.5-3.5 μ	15-25 X 4-5 μ
Length of synnemata	12-120 μ	120-800 μ



Figs. 1-3. Doratomyces eichhornius. 1. A young developing synnema. X 100. 2. A mature synnema. X 100. 3. Annellophores and catenulate conidia. X 500.

conidia secundaria ovalia cum utroque extremo truncato, subtiliter verrucosa 7-9 X 3.5-5 µ, formantia catenas cum 7-8 conidiis.

Habitat: saprophyticum in laminis Eichhorniae crassipedis (Mart.) Solms.

Mycelial hyphae hyaline, mostly superficial; synnemata formed in clumps, with conidiophores 120-180 µ in length, with the top splayed out into a loose head; annellophores 15-25 X 4-5 µ slightly swollen at the base and gradually tapering to the annellate zone; primary conidium ovate with one end truncate, secondary conidia oval with both ends truncate, minutely verrucose 7-9 X 3.5-5 µ, forming chains of 7-8 conidia.

Habitat: saprophytic on laminae of Eichhornia crassipes (Mart.) Solms. Collected by F. W. Zettler, Lake Alice, University of Florida campus, Gainesville, Florida.

Holotype: University of Florida Herbarium No. FLAS F 50399. American Type Culture Collection No. 28418.

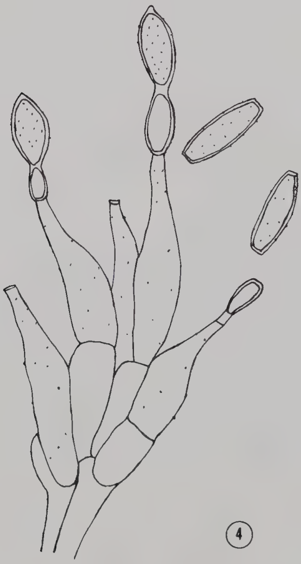


Fig. 4. Camera lucida drawing of a portion of a synnema showing verruculose conidia. X 1,000.

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SCOLECOBASIDIUM MACROSPORUM AS A SYNONYM OF SCOLECOBASIDIUM TSHAWYTSCHAE

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SUMMARY

Study of subcultures of type strains of *Scolecobasidium tshawytschae* and *S. macrosporum* demonstrated that *S. macrosporum* is conspecific with *S. tshawytschae*.

In connection with a study concerning *Scolecobasidium tshawytschae* (Doty and Slater) McGinnis and Ajello, 1974 (3) authentic living subcultures of *S. macrosporum* Roy, Dwivedi and Mishra, 1962 were unavailable for reference. We have since obtained a living subculture of the type strain of *S. macrosporum* labelled as *S. variabile* Barron and Busch, 1962 (IMI 98296) through the courtesy of the Commonwealth Mycological Institute. The affinity of *S. macrosporum* to *S. tshawytschae* is discussed in this note.

The genus *Scolecobasidium* was created by Abbott (1) to accommodate two new fungi isolated from Louisiana soils, *S. terreum* Abbott, 1927 and

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S. constrictum Abbott, 1927. The genus is characterized by having light olivaceous septate sympodioconidia that develop solitarily or in clusters upon thread-like denticles. The conidiophores are short, unbranched, smooth and light olivaceous brown in color.

Heterosporium tshawytschae Doty and Slater, 1946 was isolated from a case of phaeohyphomycosis in young chinook salmon (2). McGinnis and Ajello (3) proposed that *H. tshawytschae* be transferred to *Scolecobasidium* and that *S. tshawytschae* and *S. variabile* are conspecific.

Study of *S. macrosporum* (IMI 98296) and *S. tshawytschae* (ATCC 9915) revealed that the two isolates are essentially identical (Table 1). Thus, *S. macrosporum* is a synonym of *S. tshawytschae*.

Table 1. Characteristics of *Scolecobasidium tshawytschae* and *S. macrosporum*

	S. tshawytschae ATCC 9915	*S. macrosporum* IMI 98296
Growth at 37°C	-	+
Colony diameter at 25°C after 21 days on Potato dextrose agar	32 mm	40 mm
Colony color (Ridgeway)	deep olive, dark olive reverse	deep olive, dark olive reverse
Conidial size	9.0-19.8 x 2.2-3.6u (average 13.6 x 3.5u)	10.4-21.9 x 2.3-4.8u (average 14.0 x 3.5u)
Conidial septation	1-3	1-3
Conidiogenous cells	sympodial	sympodial

The nomenclator is as follows:

Scolecobasidium tshawytschae (Doty and Slater) McGinnis and Ajello, 1974. Trans. Brit. Mycol. Soc. 63: 202-203.

≡ *Heterosporium tshawytschae* Doty and Slater, 1946. Amer. Midl. Natur. 36: 663.

= *Scolecobasidium macrosporum* Roy, Dwivedi and Mishra, 1962. Lloydia 25: 164-166.

= *Scolecobasidium variabile* Barron and Busch, 1963. Can. J. Bot. 40: 83-84.

ACKNOWLEDGEMENTS

The authors wish to thank the Commonwealth Mycological Institute for their courtesy in supplying a living subculture of the type strain of *S. macrosporum*.

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2. Doty, M. S. and D. W. Slater. 1946. A new species of *Heterosporium* pathogenic on young chinook salmon. American Midland Naturalist 36: 663-665.

3. McGinnis, M. R. and L. Ajello. 1974. *Scolecobasidium tshawytschae*. Transactions of the British Mycological Society 63: 202-203.

MYCOTAXON

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STUDIES IN THE APHYLLOPHORALES OF AFRICA 5
CYSTOSTEREUM ARTOCREAS, NEW TO AFRICA

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INTRODUCTION

In a large collection of wood-inhabiting fungi brought back from East Africa by L. Ryvarden, there were 13 specimens of a hydnoid, resupinate species in which the tissue was conspicuously dextrinoid.

After a lengthy search in the literature and in the herbaria in Stockholm (S) and London (K) it became apparent that all specimens represented *Hydnum artocreas* Berk. & Curt. This species has previously been reported from South America and Java (see list of specimens examined). The dextrinoid reaction was lacking in the South-American material (probably due to the age and/or possibly due to some sort of chemical treatment – a most common feature when fungi were collected in the tropics in the last century when drying equipment was badly developed). The material from Java gave a weak dextrinoid reaction. Except for the dextrinoid reaction the material from Africa was in full accordance with the type of *H. artocreas.*

DESCRIPTION

Cystostereum artocreas (Berk. & Curt. ex Cooke) Hallenb. & Ryv. comb. nov.

Basionym: *Hydnum artocreas* Berk. & Curt. ex Cooke, Grevillea 20:1, 1891.

Fruitbody effused, hydnoïd, as dry very firm, crustaceous, colour cream to light brownish, margin indeterminate. Teeth when young simple with fimbriate apices, when older branched, up to 3 mm long, more or less flattened, often with smaller lateral projections, which are apically fimbriate.

Hyphal system dimitic. Generative hyphae hyaline, thinwalled, with clamps, branched, 2–3 μm in diam. Skeletal hyphae with thickened walls and a few scattered adventitious septa, branched and in the centre of a tooth running in all directions, 1–3 μm wide, hyaline and stained reddish-brown in Melzer's solution. The walls are cyanophilous. In a section of the fruitbody, not only the skeletal hyphae show the dextrinoid reaction, but also adjacent amorphous masses obviously exudated from the hyphae. In the apex of a tooth, skeletal hyphae are tortuously branched and appear as dendrohyphidia. Hyphal tissue very dense, especially in the subhymenial region. In the centre of a tooth there is much crystalline material.

Basidia cylindrical to clavate, mostly somewhat constricted in the middle, 12–20 x 3,5–4,5 μm, with 4 straight sterigmata.

Gloeocystidia cylindrical to fusiform, 21–53 x 5,5–10 μm, with a rounded apex or with an apical rounded bulb, a little protruding beyond the hymenial surface. They have a yellow resinous content and do not react to sulfovanilline.

Spores broadly ellipsoid, 2,8–3,1–4,0 x 2,2–2,7–3,5 μm, non-amyloid, adaxial side flattened, spore walls cyanophilous. Sometimes the spores are glued together in groups of 4, sometimes they adhere to protruding cystidia and dendrohyphidia.

In Africa the species is found on dead wood, altitudes 1100–2400 m.s.m., in Ethiopia, Kenya, Tanzania, and Malawi.

Among the old specimens examined, there are some which lack the crystalline material and have less frequently branched, parallely growing skeletal hyphae in the centre of the teeth. These specimens may belong to another taxon, but as no further differences are evident they are here treated as the same species.

DISCUSSION

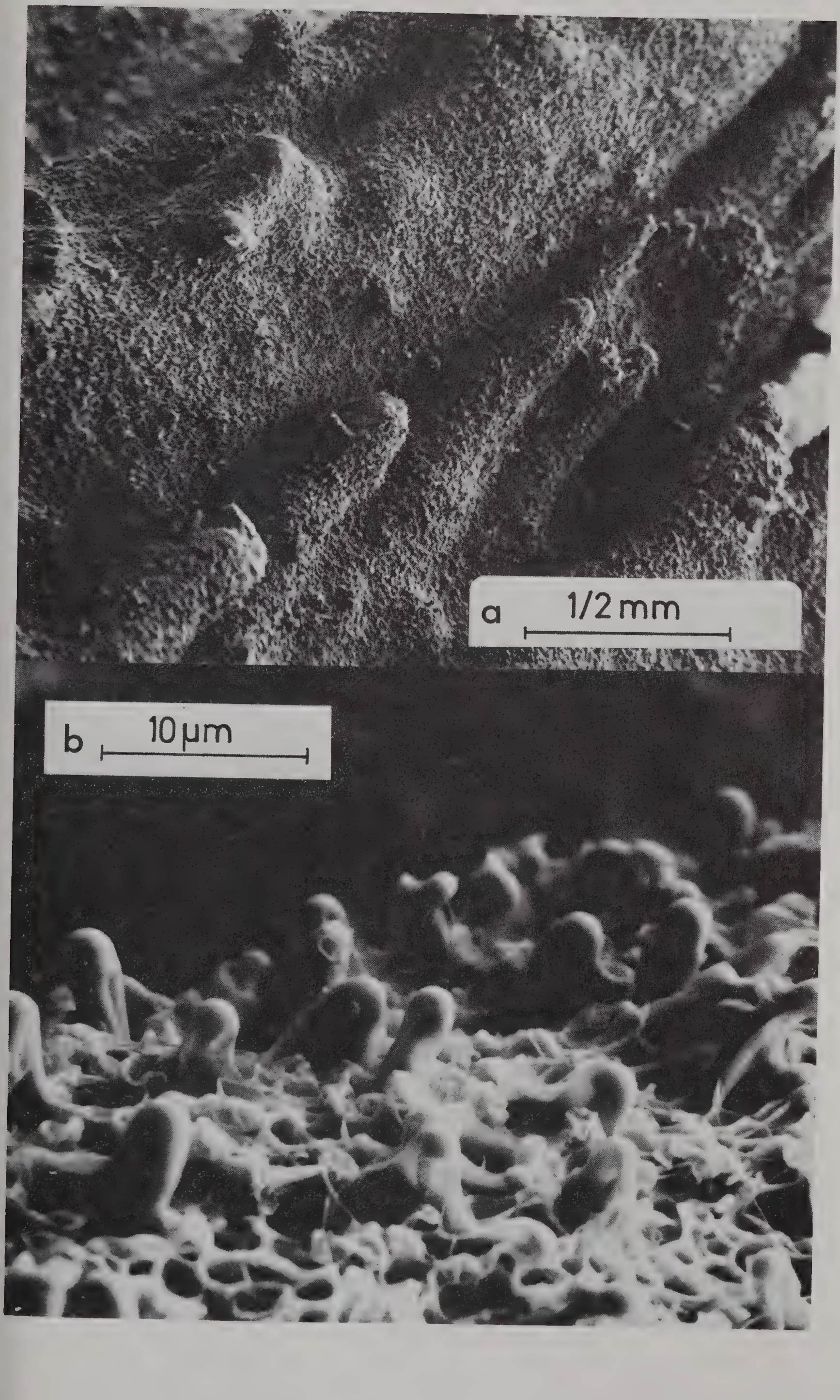
C. artocreas is close to *C. subabruptum* (Bourd. & Galz.) Erikss. & Ryv. and *C. pini-canadense* (Schw.) Parm. (Sunhede, 1972; Eriksson & Ryvarden, 1975).

They are characterized by a dimitic hyphal system, presence of dendrohyphidia, gloeocystidia with a yellow resinous content and small elliptical, non-amyloid spores.

The hymenophore of *C. pini-canadense* is almost smooth, that of *C. subabruptum* odontioid and of *C. artocreas* hydnoid. The latter also differs by having dextrinoid skeletal hyphae and more rounded spores.

These three species differ from the type of the genus, *C. murraii* (Berk. & Curt.) Pouz., which has no dendrohyphidia, lots of gloeocystidia in the subiculum and oily instead of resinous content in the gloeocystidia. From these reasons we suggest a new subgenus:

Figure 1. *Cystostereum artocreas.* a) lower part of large, slightly flattened tooth with typical lateral protuberances or "sideteeth" b) part of hymenium with collapsed basidia and projecting gloeocystidia. – Coll. Ryvarden 5136.


a
1/2 mm
b
10 µm

Cystostereum subg. **Dendrohyphidium** subgen. nov.

Subgeneri Cystostereo affine sed cum dendrohyphidiis, gloeocystidia materiam resinosam vice substantiae oleaceae continentia, gloeocystidia in subiculo desunt. Hymenophorum plus minusve leve, vel hydnoideum.

Hyphae skeleticae non dextrinoideae, interdum dextrinoideae. Subgeneric type: *Cystostereum subabruptum* (Bourd. & Galz.) Erikss. & Ryv., Corticiceae of N. Europe, vol. 3, p. 327, 1975 *(Odontia subabrupta* Bourd & Galz., Hym. de France, p. 430, 1928).

Included species: *C. pini-canadense* (Schw.) Parm., *C. artocreas* (Berk & Curt. ex Cooke) Hallenb. & Ryv.

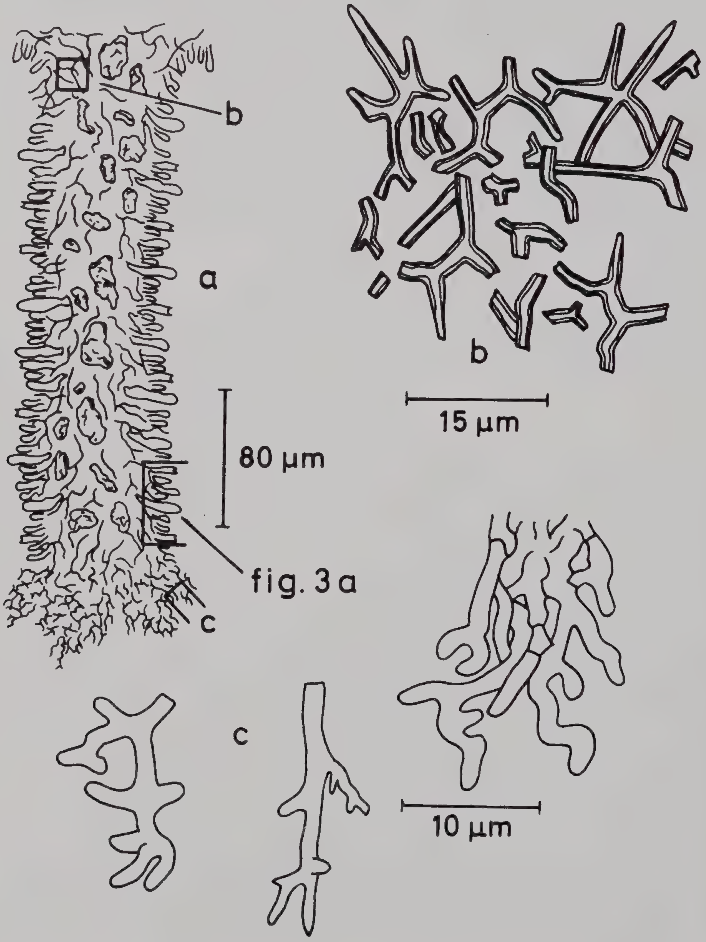


Figure 2. *Cystostereum artocreas.* a) section through tooth showing positions of sections b and fig. 3a b) skeletal hyphae from the centre of the tooth c) dendrohyphidia – Coll. Ryvarden 10350.

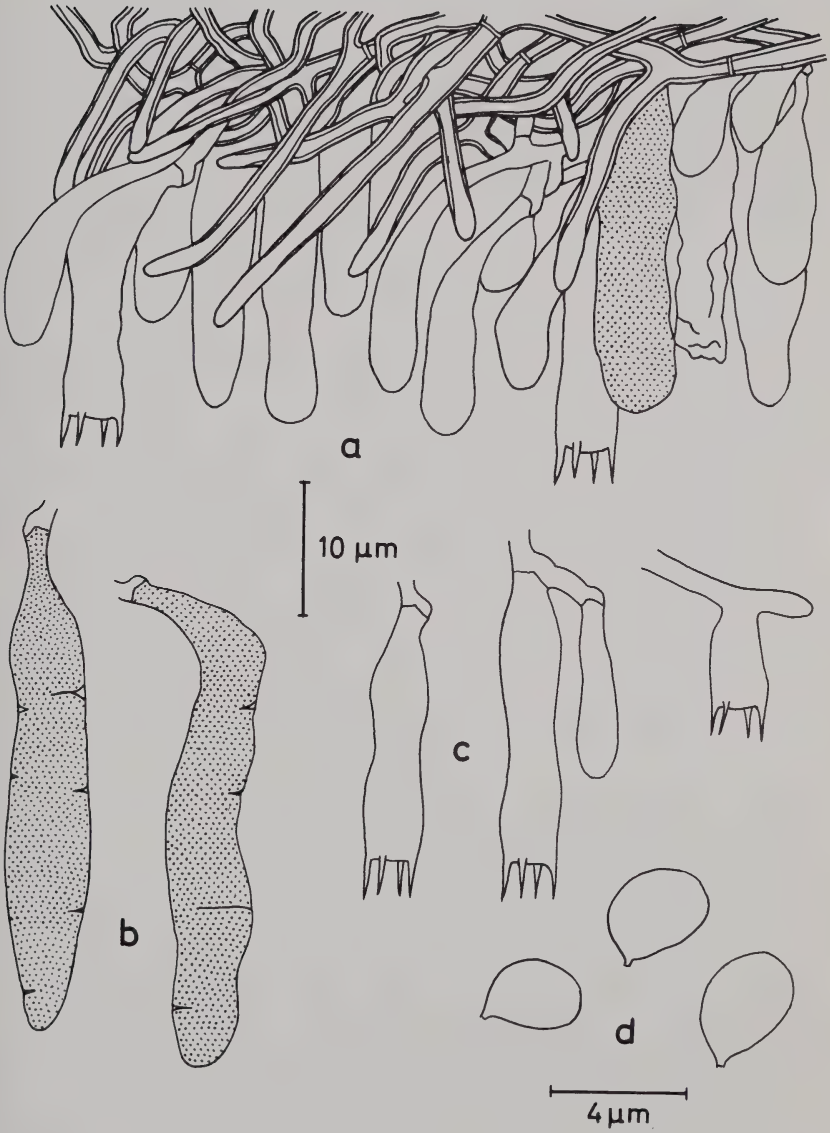


Figure 3. *Cystostereum artocreas.* a) section through hymenium with basidia and gloeocystidia b) gloeocystidia c) basidia d) spores. – Coll. Ryvarden 10350.

SPECIMENS EXAMINED

Africa:

Ethiopia, Arussi prov., Wondo Genet, 12 km SE Shashemene, alt. c. 1900 m.s.m., 7° 5' N 38° 45' E, 1973-01-08, L. Ryvarden 8735 (O).

Kenya, Central prov., Mt. Elgon, Suam Forest Sta., alt. c. 2100 m.s.m., 1° 15' N 34° 50' E, 1973-01-23, L. Ryvarden 9201 (O).

Kenya, Western prov., Kakamega Forest, c. 13 km E-SE of Kakamega, alt. c. 1500 m.s.m., 0° 15' N 34° 50' E, 1973-01-25/27, L. Ryvarden 9416, 9523, 9582 (O).

Tanzania, Kilimanjaro prov., Mt. Kilimanjaro, W slope, E of Lemosho Glades, montane forest, alt. c. 2400 m.s.m., 3° 1' S 37° 9' E, 1971-01-17, L. Ryvarden 5136, 5159 (O).

Tanzania, Arusha prov., Arusha Nat.park, Mt. Meru, E slope, road to the crater, alt. 1800-2300 m.s.m., 3° 14' S 36° 47' E, 1973-02-08, L. Ryvarden 10020, 10061 (O).

Tanzania, Kilimanjaro prov., Mt. Kilimanjaro, S slope above Mweka, alt. 1800-2300 m.s.m., 3° 14' S 37° 20' E, 1973-02-12, L. Ryvarden 10350 (O).

Tanzania, Morogoro prov., Morogoro distr., Uluguri Mts. Morning Side Res. Sta., c. 5 km S of Morogoro, alt. 1500-2100 m.s.m., 6° 55' S 37° 40' E, 1973-02-24/26, L. Ryvarden 11052 (O).

Malawi, Southern prov., Mulanje distr., Mulanje Mts. Lichenya Plateau, alt. 1800-2000 m.s.m., 15° 58' S 35° 30' E, 1973-03-09, L. Ryvarden 11299 (O).

Malawi, Southern prov., Thyolo distr., Thyolo mt., alt. 1100-1400 m.s.m., 16° 5' S 35° 4' E, 1973-03-13, L. Ryvarden 11551 (O).

South America:

Venezuela, 1879, Berkeley and Curtis 139 (Type) (K, BPI).

Saint Vincent (K) (without date and collector).

Brazil, Parecy, 1924, J. Rick (BPI).

Brazil, Sao Leopoldo, 1903, J. Rick (Hb. Bresadola 29) (S).

Brazil, Sao Leopoldo, in ligno frondoso, 1906, J. Rick 116 (BPI, UPS, S).

Brazil, Blumenau, A. Möller 111, 330 (S).

Brazil, Rio Grande do Sul, 1906, Sao Leopoldo, J. Rick (Theissen no. 163) (S).

Asia:

Java, Tjibodas, 1908, comm. v. Höhnel (BPI).

The herbaria are abbreviated in accordance with Index Herbariorum (Regnum Vegetabile, Vol. 92).

ACKNOWLEDGEMENT

We are much indebted to Dr. John Eriksson, Göteborg, for valuable discussions.

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Eriksson, J. & Ryvarden, L. 1975. The Corticiaceae of North Europe. Vol. 3. Oslo.

Sunhede, S. 1972. Odontia subabrupta Bourd. & Galz. (Basidiomycetes), a Species of Corticiaceae New to Sweden. Sv. Bot. Tidskr. 66:285-289.

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NOTICES

LICHEN EXCHANGE ESTABLISHED

The American Bryological and Lichenological Society established its first Lichen Exchange during 1974, with Claire Schmitt as Director.

Students as well as professionals are invited to participate. Interested persons may write to Mrs. Claire Schmitt at 1 Cedar Lane, Scotia, New York 12302, for information.

RECENT WORK ON THE MYCOLOGICAL COLLECTIONS OF THE FARLOW HERBARIUM

Through several decades of prudent purchases, donations and exchange, the Farlow Reference Library and Herbarium of Cryptogamic Botany has become one of the largest depositories of critically studied cryptogamic specimens in North America. Under a National Science Foundation Grant, this large and invaluable reference collection has been receiving long needed curatorial attention. Dr. Geneva Sayre, Research Associate at the Farlow Herbarium, has recently outlined the progress of these activities in the bryophyte herbaria (Taxon 23: 215-216. 1974) where most of the work had been concentrated previously. This is a similar review of the progress in the mycological collections. I hope that such information will encourage mycologists to use the collections both as a source and as a depository. The Farlow Herbarium and Library welcomes reprints, specimens, and loan requests.

Traditionally, the fungus collections have been divided into three categories: (1) the general herbarium; (2) the special, separately maintained herbaria; and (3) the undistributed exsiccati.

The General Herbarium — This collection contains the incorporated herbaria of W.G. Farlow, R. Thaxter, D.H. Linder, J.H. Faull (in part), W.L. White, F.V. Bucholtz, and F. Theissen. The mycological collections of W.H. Weston have also been sorted and added to the general herbarium. The Weston herbarium contains authentic and type material of species of *Sclerospora* and also contains collections from the Philippines and Barro Colorado. Many specimens in the general collection recently have been protectively repacketed. The index to types is also being updated.

With the aid of Dr. Josiah Lowe, Honorary Research Associate of the Farlow Herbarium, the Polyporaceae have been

(continued on page 184)

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PENIOPHORA TAMARICICOLA IN NORTH AMERICA[1]

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Field work over the past 5 years in southern Arizona has disclosed the presence of a fungus previously unreported from North America. This fungus is *Peniophora tamaricicola*, described in 1961 by Boidin and Malençon from Morocco, where it was reported as common on *Tamarix*.

Peniophora tamaricicola is one of the important decay fungi on dead branches of several Sonoran Desert shrubs and trees. It is particularly common in Arizona on mesquite (*Prosopis juliflora* (Sw.) DC.) and can generally be found in all areas where mesquite with dead branches is present.

The following description is based on the collections cited from Arizona.

PENIOPHORA TAMARICICOLA Boidin et Malençon in Boidin, Rev. Mycol. 26: 153. 1961.

Basidiocarps resupinate, becoming widely effused, adnate, drying tough and horny in consistency and cracking extensively into small angular blocks; hymenial surface smooth to distinctly tuberculate, pruinose, pink when fresh, pale purplish-gray on dried specimens (Pale Smoke

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[1] University of Arizona Agricultural Experiment Station Journal Article No. 2419.

Gray, Pallid Mouse Gray or Light Gull Gray)[2]; margin abrupt and fertile; subiculum pale brown, hymenial layer lighter in color and distinct in longitudinal sections; hyphal system monomitic; subicular hyphae (Fig. 1a) 3-4 µ

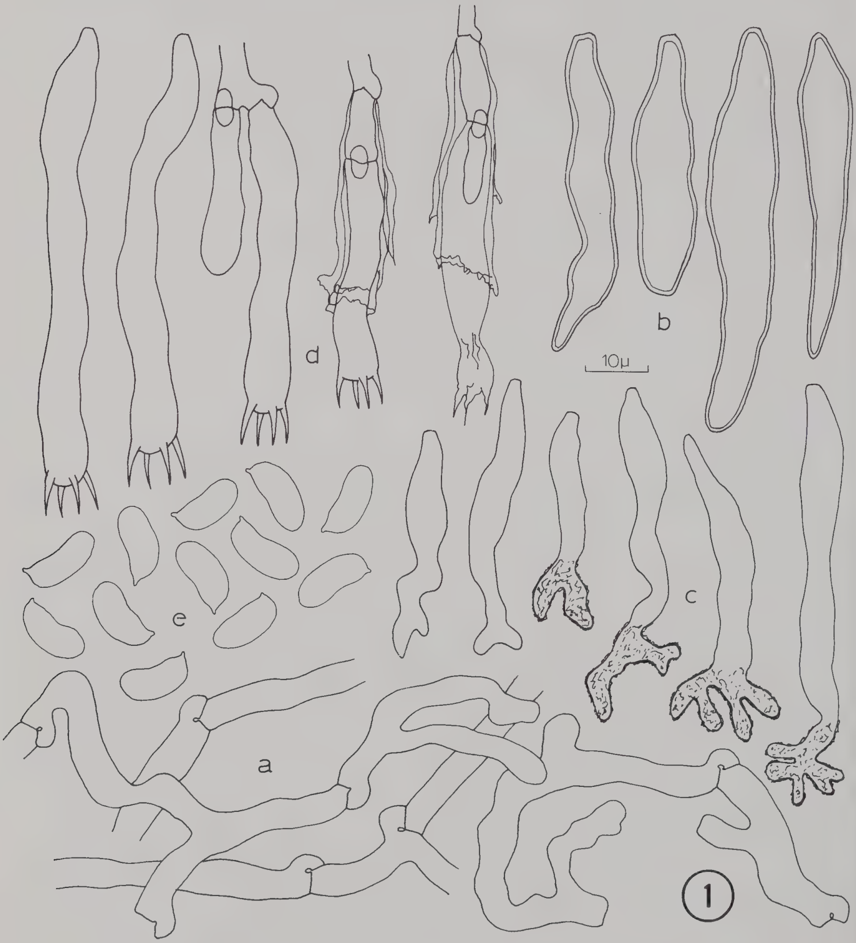

Fig. 1. Microscopic characters of basidiocarp of *Peniophora tamaricicola*. a. subicular hyphae; b. gloeocystidia; c. dendrohyphidia; d. basidia; e. basidiospores.

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[2] Color notations are those of Ridgeway (1912).

in diam, agglutinated and difficult to separate, yellow-brown near substrate, thin- to thick-walled, all with inconspicuous clamp connections, swollen vesicular gloeocystidia present in subiculum, some with refractive granular contents, strongly positive in sulphuric benzaldehyde reagent; hymenial gloeocystidia (Fig. 1b) occasional, projecting slightly, acuminate, some with refractive contents, weakly to distinctly positive in sulfuric benzaldehyde reagent, up to 60 x 10 μ; dendrohyphidia (Fig. 1c) present, lightly to heavily incrusted, sparsely branched, stalk 2-5 μ in diam; basidia (Fig. 1d) narrowly clavate or slightly swollen at the base, 4-sterigmate, 40-65 x 7-7.5 μ, developing by percurrent proliferation, with new basidia developing through old basal septa and ensheathed in collapsed walls of old basidia; basidiospores (Fig. 1e) cylindric to allantoid, hyaline, smooth, thin-walled, negative in Melzer's reagent, 10.5-11.5 x 4-4.5 μ; spore print orange-white to light orange. Associated with a white rot of dead branches.

Specimens Examined from Arizona:--(at ARIZ or CFMR)[3]

on *Baccharis sarothroides* Gray (desert broom): RLG 10056 and 10061, Madera Canyon, Santa Rita Mts., Pima County.

on *Celtis reticulata* Torr. (western hackberry): ERC 71-245,and 71-247, Guadalupe Canyon, Peloncillo Mts., Cochise County.

on *Cercidium microphyllum* (Torr.) Rose et Johnst. (yellow palo verde): RLG 10237 and HHB 5952, Redington Rd., Rincon Mts., Pima County.

on *Condalia mexicana* Schlect. (Mexican blue-wood): RLG 10585, Peck Canyon Rd., Tumacacori Mts., Santa Cruz County.

on *Fouquieria splendens* Engelm. (Ocotillo): RLG 7741, Guadalupe Canyon, Peloncillo Mts., Cochise County.

on *Fraxinus velutina* Torr. (velvet ash): ERC 71-248 and HHB 6225, Guadalupe Canyon, Peloncillo Mts., Cochise County; HHB 5994, 5995, Sycamore Canyon, Atascosa Mts., Santa Cruz County.

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[3] Herbarium abbreviations are those of Stafleu (1974).

on *Juglans major* (Torr.) Heller (Arizona black walnut): RLG 10257, Sycamore Canyon, Atascosa Mts., Santa Cruz County.

on *Prosopis juliflora* (Sw.) DC. (common mesquite): RLG 7182, Sonoita Cr., Patagonia, Santa Cruz County; RLG 8368A, Kelley's Wash, Santa Catalina Foothills, Pima County; ERC 70, Cottonwood Springs, Sonoita Cr., Santa Cruz County; ERC 176, Box Canyon 10 mi. east of Florence, Pinal County; RLG 10040, Patagonia Mts., Santa Cruz County; RLG 10055, HHB 5849 and 5855, Santa Rita Experimental Range, Santa Rita Mts., Pima County; HHB 5883, highway 90, S.E. of Sierra Vista, Cochise County; RLG 10234, HHB 5948 and 5953, Redington Rd., Pima County; RLG 10361 and ERC 71-250, and HHB 6223, Guadalupe Canyon, Peloncillo Mts., Cochise County; RLG 10388 and ERC 71-254, Aravaipa Canyon, Pinal County; ERC 71-271, Peppersauce Canyon, Santa Catalina Mts., Pima County; ERC 71-327, near Kitt Peak Rd. on highway 86, Papago Indian Res., Pima County; ERC 71-355, Camp Grant Wash, Pinal County; RLG 10577, Peck Canyon Rd., Tumacacori Mts., Santa Cruz County; RLG 10792, highway 90, N. of Sierra Vista, Cochise County; HHB 7263, Old Spanish Trail near Collossal Cave, Pima County; HHB 6221, Guadalupe Canyon, Sonora, Mexico.

Peniophora tamaricicola was originally described as common on *Tamarix* in Morroco. *Tamarix aphylla* (L.) Karst. (athel) and *T. gallica* L. (salt-cedar) are both common introduced plants in southern Arizona, but we have not yet found *P. tamaricicola* on them.

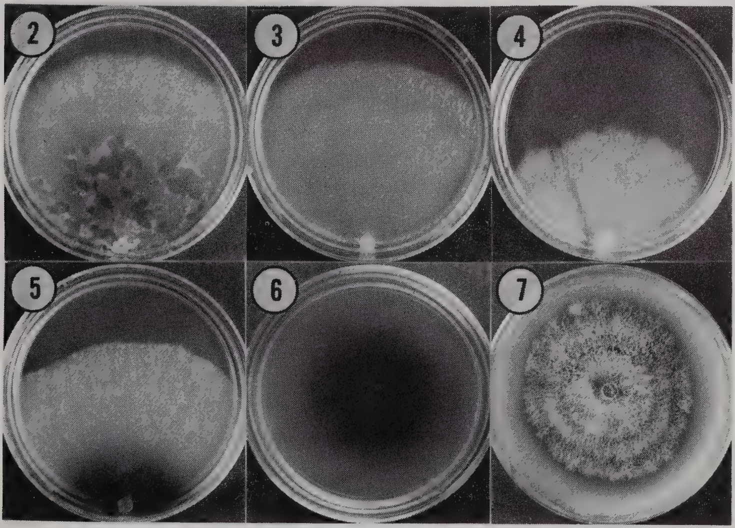
Of special interest is the development of the basidia by means of percurrent proliferation. This phenomenon has never been reported for a member of *Peniophora* Cke. sect. *Coloratae* Bourd. et Galz.

The Arizona specimens have been compared with an isotype of *P. tamaricicola* (LY No. 3928) sent by Dr. Boidin and found to agree well in all respects.

Peniophora tamaricicola was readily isolated from mass basidiospore deposits and grew vigorously on 1.5% Difco Bacto malt extract-agar medium.

Cultural Characteristics:

Growth on malt extract-agar (MEA) slow to medium, 15-30 mm diam/week at 25°C; advancing zone white and woolly, mat (Figs. 2,3,4,5) after two weeks with white, appressed powdery surface, sometimes with appressed, sodden circular areas; powdery layer forming a tough membrane on agar surface, and remaining white for several weeks; later becoming tan, some areas with sparse loosely interwoven aerial hyphae developing above surface, especially at the edge of dish, producing a thick woolly rim; agar stained brown in most isolates, sometimes only after 3 weeks, one isolate lost this ability; odor of apricots; on gallic acid medium (Fig. 6) no growth in two weeks, the agar stained up to 1 cm from inoculum; on tannic acid medium (Fig. 7) growth 5-12 mm in radius/week, mat white, becoming tan, texture appressed woolly, margin irregular, abrupt; agar stained about 5 mm beyond margin of mat; reaction to syringaldazine (Harkin and Obst, 1973) strongly positive (Spinel Red to Acajou Red) indicating laccase production.



Figs.2-7. Cultures of *P. tamaricicola* after 2 weeks. 2. HHB 5948 on MEA; 3. HHB 5883 on MEA; 4. HHB 5953 on MEA; 5. RLG 10792 on MEA; 6. RLG 10792 on gallic acid medium; 7. RLG 10792 on tannic acid medium.

Hyphae of two types throughout cultures; some 2.5-4 μ broad, thin-walled, hyaline, clamped, frequently branched, with some irregular swelling, these constant in the marginal, aerial (Fig. 8a) and submerged hyphae (Fig. 8c);

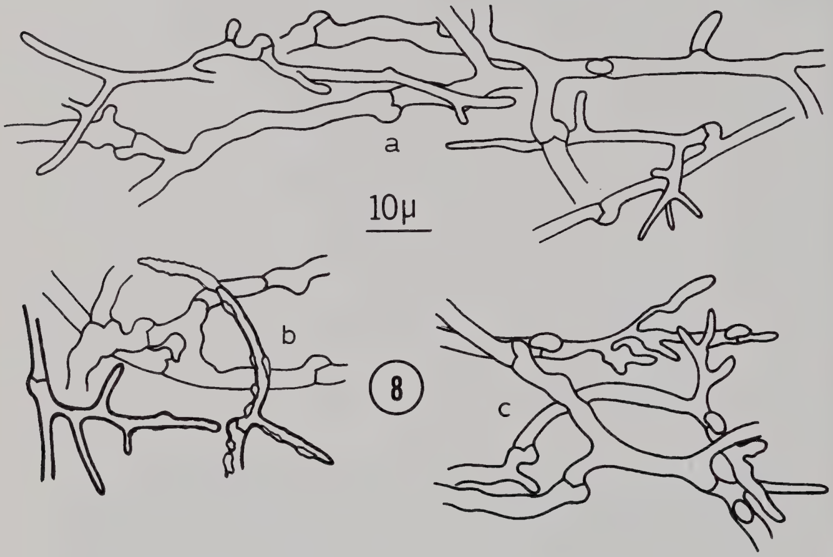


Fig. 8. Microscopic characters of culture of *P. tamaricicola*. a. hyphae from aerial mycelium; b. hyphae from membranous mat; c. hyphae from submerged mycelium. All from HHB 5883.

others 0.5-2 μ broad, hyaline, clamped, thin-walled or with slight wall thickening; in membranous mat (Fig. 8b) hyphae agglutinated and densely entangled, walls up to 0.5 μ thick, with yellow tint and yellow encrusting material appearing as irregular wall thickening after several weeks.

Temperature Relations: Average mat diameters in 21 days in the dark (except for measuring time) at constant temperature follow: 4°, no growth; 12°, 26-40 mm; 16°, 31-49 mm; 20°, 49-75+mm; 28°, 56-75+mm; 32°, 33-64 mm; 36°, 1-3 mm; 38 and above, no growth.

Cultures studied: HHB 5883, 5948, 5953, RLG 10792, all at CFMR.

Remarks: The appressed, powdery, tough membrane with the sodden "poc-like" areas combined with the brown staining of the malt agar is distinctive for this fungus. These isolates have a tendency to vary substantially in growth rate. Other characters, such as the mat texture and coloration vary among individual runs on the same isolate more than is usually experienced. The ability to stain the agar has been lost in one isolate (5953) while another (5883) bleaches the agar and stains the agar brown only in age.

The key pattern according to the system used by Davidson, et al. (1938) is A-P-I-1-10-14. The species code according to the system used by Nobles (1965) is 2.3.7.8.36.39.43.44.50.54.

Acknowledgments

Work at the University of Arizona was supported by McIntire-Stennis funds allocated through the University of Arizona Agricultural Experiment Station. Collections designated with the initials ERC were made by Dr. E. R. Canfield whose participation in the field work is gratefully acknowledged. Thanks is also extended to Ms. Teresa E. Scotton for her technical assistance.

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Vol. II, No. 1, pp. 151-165 April-June 1975

SPECIFIC AND INFRASPECIFIC NAMES FOR FUNGI USED IN 1821.

PART II. C, AND SUPPLEMENT TO PART I.[1]

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In Part I of this series (Mycotaxon vol. 1, no. 3), the 1821 system of starting dates for "Fungi Caeteri" was examined, with a summary of the 1821 literature (as discovered to that writing) and some pre-1821 literature sources. The present "chapter" takes up names starting with C.

No additional 1821 references have been uncovered since the writing of Part I, but a number of additional pre-1821 citations have been examined, and these are reported below. They by no means begin to summarize *all* the pre-1821 literature dealing with fungi, which would include literally scores of obscure floras and summaries of the known species, all "according to the system of Linnaeus", but those included here have all been cited by the 1821 authors. Finally, some literature which should have appeared in Part I was inadvertantly omitted, and has been added here.

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[1] This paper represents contribution No. 445 from the Botanical Laboratories, University of Tennessee.

Some notes:

On one hand, an announcement in Römer's "Neues Magazin für die Botanik" (1: 129-137) states a date for Bulliard's "Histoire ..." (BH) as 1791. In BH, the preface to Part I (page v) reads: "C'est en 1790 que j'ai commencé à publier les planches de cet ouvrage ...." In the errata following page 368, however, there appears a footnote: "Errata. Preface, page v, ligne 28 ... *au lieu de*, c'est en 1790 in j'ai commencé à publier les planches .. *lisez*, c'est in 1780." Presumably, one could surmize that the *plates* for Part I appeared in 1780, but the text perhaps later, or perhaps the plates were *printed* in 1780, but were not issued until 1791. The situation is not yet clear in my mind.

The dating of Schaeffer's "Fungorum ..." (Sch), especially volume 4 where binomials are used, is uncertain. this volume has been widely cited as 1800 (as appears on the title page), but the preface is dated April, 1774. It was probably issued in that year, and citations to Schaeffer binomials by subsequent authors occur shortly thereafter, and well before 1800. In Jacquin's "Collectae ..." (WJ 2: 106, for example), however, Schaeffer's names are quoted as polynomials. WJ appeared in 1781. Did Sch 4 appear *after* that date, and if not, why did WJ use the polynomials from Sch 1-3 rather than binomials from Sch 4?

Additional pre-1821 literature

EHor: Ehrenberg, C.G. 1820. Enumeratio fungorum, a viro clarissimo A. d. de Chamisso sub auspiciis Romanzoffianis in itinere circa terrarum globum collectorum. *in* Link, H., C. Asm. Rudolph, W. Fr. Klug, C.G. Nees von Esenbeck, Adalb. Chamisso, Fr. Hornschuch, D. Schlechtendal & C.G. Ehrenberg. Horae physciae Berolinensis collectae ex symbolis vivorum doctorum. pp. 77-104 + xvii-xx. [preface dated 15 May, 1819.]

JFA: Jacquin, N.J. Florae Austriacae sive plantarum selectarum in Austriae archiducatu sponte crescentium, icones, ad vivum coloratae, et descriptionibus, ac synonymis illustratae. Vienna.
Volume 1. 1773. 61 + pls. 1-100
Volume 2. 1774. 60 + pls. 101-200
Volume 3. 1775. 55 + pls. 201-300
Volume 4. 1776. 53 + pls. 301-400
Volume 5. 1778. 56 + index + pls. 401-500 + 50 pls.

LFF: Lamarck, "1778" [1779, cf. p. 1]. Flore Francoise, ou description succincte de toutes les plantes qui croissent naturellement en France, disposée selon une nouvelle methode d'analyse, & à laquelle on a joint la citation de leurs vertus les moins équivoques en médecine, & de leur utilité dans les arts. Volume 1: cxix + 223 [principes] + 132 [methode analytique] + xxix [indices] + 8 plates.

PFO: Palisot-Beauvois, A.M.F.J. Flore d'Oware et de Benin, en Afrique. Paris.
Volume 1. 1804. xii + 100 p + 60 pls.
Volume 2. 1807. 95 pp + pls. 61-120.

PJB: Persoon, C.H. 1809. Memoire sur les Vesse-loups ou *Lycoperdon*. Jour de Bot. 2: 5-31 + 1 pl.

PRNB: Persoon, C. H. 1794. Neuer Versuch einer systematischen Eintheilung der Schwämme. Neues Mag. f. d. Bot., Römer 1: 63-128.

PRR: Pallas, P.S. Reise durch verschiedene provinzen des Russischen Reichs in einem ausfuhrlichen Auszuge. Frankfurt & Leipzig.
Volume 1. 1776. 304 + 52 anhang + 15 pls.
Volume 2. 1777. 464 + 51 anhang + 26 pls.
Volume 3. 1778. 488 + 80 anhang + 40 pls.

Sae: Schumacher, Christ. Frieder. Enumeratio plantarum in partibus Saellandiae septentrionalis et orientalis. Hafniae.
Volume 1. 1801. vii + 304.
Volume 2. 1803. 489 pp.

Sch: Schaeffer, Jacob Christian. Fungorum qui in Bavaria et Palatinatu circa Ratisbonam nascuntur icones nativis coloribus expressae. Ratisbonam.
Volume 1. 1762. pls. 1-100 + accom. text.
Volume 2. "1767" [1763]. pls. 101-200 + accom. text.
Volume 3. "1770" pls. 201-300 + accom. text.
Volume 4. undated [1774]. pls. 301-330 + 136 pp. "index" + index to plates [preface dated April, 1774].
[In the copy of volume 2 at NY is found the following handwritten note: "Apparently this and the following (German) one are revised title-pages with new date. The preface is dated 1763, and the entire volume was *certainly* issued *that year*. (see

review in Comment. Sci. Nat. Gleditsch 12: 98-101. 1764.)"]

SEB: Smith, James E. English botany, or, coloured figures of British plants, with their essential characters, synonyms and places of growth; to which will be added, occasional remarks.
Volume 25 (1807). Pls. 1729-1800. London.

SEF: Sowerby, James. Coloured figures of English fungi or mushrooms.
Volume 1. 1797. pls. 1-120 + accom. text.
Volume 2. 1799. pls. 121-240 + accom. text.
Volume 3. 1803. pls. 241-400 + accom. text.
Supplement (undated). pls. 401-439 + accom. text.

SpM: Sprengel, Curt. 1807. Mantissa prima. Florae Halensis, addita novarum plantarum centuria. 58 pp. Halae.

SS: Schultz, Carolo Friederico. 1806. Prodromus florae Stargardiensis continens plantas in ducatu Megapolitano-Stargardiensi s. Strelitzensi sponte provenientes. 530 pp. Berolini.

WBA: Withering, William. A botanical arrangement of British plants including the uses of each species, in medicine, diet, rural oeconomy, and the arts. With an easy introduction to the study of botany, etc., etc. The second edition. London.
Vol. 3 (1792) introduction + 503 + 4 pls.

WFL: Wahlenberg, Georgii. 1812. Flora Lapponica exhibens plantas geographice et botanicae consideratas, in Lapponiis Suecicis scilicet Umensi, Pitensi, Lulensi, Tornensi et Kemensi, nec non Lapponiis Norvegicis scilicet Norlandia et Finmarkia utraque indigenas, et itineribus annorum 1800, 1802, 1807 et 1810 denuo investigatas. lxvi + 550 + 30 pls. Berolini.

WH: Wiggers, Fridericus Henricus. 1780. Primitiae Florae Holsaticae. Kiliae. introd. + 112 pp.

WJ 1: Wulfen, Francisci Xaverii. 1778. Plantae rariores Carinthiacae, *in* Jacquin, N.J., Miscellanae Austriaca ad Botanicam, Chemiam, et historiam naturalem spectantia, cum figuris partim coloratis. 1: 147-163.

WJ 2: Wulfen, F.X. 1781. Plantae rariores Carinthiacae, *in* Jacquin, N.J., ibid. 2: 25-273.

WSA: Withering, William. 1801. A systematic arrangement of British plants, with an easy introduction to the study of botany. The fourth edition, in four volumes. Vol. 4: 409 pp. London.

-- A --

Additions and corrections (cf. Part I)

abietinum (Hericium) Schl: 57 ← [Schr: 181 (Hydnum)]
abietinus (Boletus) Schl: 56, P: 242, G: 643 ← [PS: 541 ← Dick 3: 21]
abietinus (Polyporus) Fr: 370 ← [PS: 541 (Boletus) ← Dick 3: 21 (Boletus)]
acris (Agaricus) P: 397, N&B: 326, R: 30 ← [Bolt: pl. 60]
aeruginosum (Fusidium) G: 544 ← [LM 3: 8]
aggregatus (Agaricus gymnopus) Z: 98† ← [Sch 4: 72]
alba (Clavaria muscoides var.) M: 32, var. nov.
alba (Helvella mitra var.) SA: 537, M: 29 ← [BH: 298, pl. 190, figs. A, B, C, F; pl. 466]
alba (Peziza imberbis var.) M: 22-23 ← [BH: 245, pl. 467, fig. 2]
alba (Peziza labellum var.) M: 25-26 ← [BH: 262, pl. 204]
alba (Peziza stipitata var.) M: 24 ← [BH: 271, pl. 457, fig. 2]
alba (Peziza vesiculosa var.) M: 25 ← [BH: 270, pl. 457, fig. 1E-F]: Fr 2: 52
alba (Tremella mesenteriformis var.) M: 28-29 ← [BH: 230, pl. 406, fig. c]
albus (Agaricus muscarius var.) P: 201-202, var. nov.†
albus (Agaricus pectinatus [var.]) SA: 562, var. nov.
allochroa (Botrytis) G: 553 ← [LM 3: 14]: Fr 3: 402
alni (Erysiphe) Re: 55, M: 131, G: 589, as "Erysibe" ← [LDC: 57]
alternatum (Acremonium) G: 550 ← [LM 3: 15]: Fr 3: 425
amanitae (Agaricus tuberosus var.) M: 72 ← [BEFC 1: 109 (Agaricus ______)]
amethystea (Auricularia reflexa var.) M: 34 ← [BH: 282, pl. 483, figs. 1A-F]
artocreas (Sphaeria) FSS no. 151 ← [TM 2: 20]: Fr 2: 523
asclepiadicola (Sphaeria lichenoides var.) M: 146, var. nov.
aucupariae (Hypoderma xylomoides var.) M: 152, var. nov. ?†
aurantiaca (Byssus) SA: 526, M: 12 ← [LDC: 13]
aurantiaca (Clavaria muscoides var.) M: 32, var. nov. ?†
aurantiaca (Himantia) LD 21: 165 ← [LDC: 13(Byssus)]
aureum (Sporotrichum) G: 551 ← [LM 3: 13, as "Sporothrichum"]: Fr 3: 418

-- B --

Additions and corrections (cf. Part I)

badium (Sporotrichum) G: 551 ← [LM 3: 12, as "Sporothrichum"]
ballotaecola (Sphaeria lichenoides var.) M: 146, var. nov.
barbajobi (Hydnum) M: 37 ← [With III 4: 337 "barba-jovis" ← BH: 303, pl. 481, fig. 2 "barbajovis"]
berberidis (Hypoderma xylomoides var.) M: 152, var. nov. ?†
betaecola (Sphaeria lichenoides var.) M: 146, var. nov.
bicolor (Stachylidium) G: 553 ← [LM 3: 15]: Fr 3: 391
brassicae (Astoma) G: 524 ← [Dick 1: 23 (Sphaeria) ← "Bergius, Acta Holm. 1765: 213" (Lycoperdon)]
buccinalis (Merulius) P: 180 ← [With IV 4: 149]
buxicola (Sphaeria lichenoides var.) M: 147, var. nov.

-- C --

caerulea (Auricularia) M: 35-36 ← ["Lamarck, Fl. Franc. 1: 103"]
caerulea (Peziza) G: 665 ← [Bolt: 108, pl. 108, fig. 2]: Fr 2: 86 "coerulea"
caerulea (Thelephora) SA: 544 ← ["Lamarck, Fl. Franc. 1: 103"]
caeruleum (Hydnum suaveolens [var.]) Fr: 402, not through 406 ← [FD 22: 7, pl. 1374 "coeruleum"]
caerulescens (Cortinaria cyana [var.]) G: 627 ← [PS: 277 (Agaricus cyanus [var.] ______) ← Sch 4: 17 (Agaricus ______)]
caerulescens (Agaricus pratensis ______) HFD: 12, t. 1731, fig. 1† ← [Fr: 100 (Agaricus pratensis β ericosus b. ______)]
caeruleus (Hypochnus) Schl: 58, LD 22: 368 ← [DC 2: 107 ← "Schrader in Schleicher, Crypt. Exs."]
caesarea ([Agaricus] aurantiacus var.) M: 88 ← [PS: 252 (Amanita)]
caesarius (Agaricus) Fr: 15, not 5 ← ["Scopoli, Fl. Carn. II p. II, p. 419"]
caesia (Peziza) G: 665 ← [PS: 657]: Fr 2: 108
caesia (Thelephora) Fr: 449 ← [PS: 579 ← POM 1: 15, t. 3, fig. 6 (Corticium)]
caesium (Gonytrichum) LD: 19: 194 ← ["Nova Acta Akad. Leop.-Carol. Nat. Cur. 9: 244"]: Fr 3: 348 (Myxotrichum)
caesium (Boletus) G: 640 ← [Schr: 167]
caesius (Polyporus) Fr: 360 ← [Schr: 167 (Boletus)]
caespitosa (Monilia) P: 320-321 ← ["Relhan, ed. alt. no. 1342"]
caespitosa (Onygena) M: 127 ← [PJB 2: 30]
caespitosa (Sphaeria) Spr: 279 ← [TM 2: 41]
calamistratus (Agaricus) Fr: 256, sp. nov.
calcea (Auricularia) M: 35 ← [PS: 581 (Thelephora)]
calcea (Thelephora) L: 469, SA: 543 ← [PS: 581]
calceoliformis (Grifola badia [var.]) G: 644 ← [BH: 338 (Boletus "calceolus")]
calceolus (Boletus) M: 43, SA: 552 ← [BH: 338, pl. 360]
calciiformis (Crinula) Fr: 493, sp. nov.
calicioides (Peziza) M: 23 ← [DC 2: 81]: Fr 2: 115
callisteus (Agaricus) Fr: 228 ← [FO 2: 51]
callochroa (Cortinaria) G: 629 ← [PS: 282-283 (Agaricus)]
callosa (Peziza) M: 21, SA: 530-531 ← [BH: 254, pl. 416, fig. 1]
callosus (Agaricus) Fr: 292, nom. nov.
callosus (Polyporus) Fr: 381, nom. nov.
calochrous (Agaricus) Fr: 224 ← [SpM: 16, "callochrous"]
calophyllus (Agaricus) Fr: 210 ← [PS: 464]
calopus (Agaricus) Fr: 130 ← [PS: 373, "callopus"]
calopus (Boletus) Fr: 390 ← [PS: 513]

calthaecola (Sphaeria lichenoides var.) M: 147, var. nov.
calva (Sphaeria) Schl: 59 ← [TM 2: 16]: Fr 2: 451
calyculus (Peziza) P: 458 ← [BEF: 123, pl. 12, fig. 57]
camarophyllus (Agaricus) Fr: 99 ← [A&S: 177]
cameleo (Agaricus) M: 73 ← [BH: pl. 545, fig. 1, "cameleon"]
campanella (Agaricus) Fr: 166, not 167 ← [BEF: 74]
campanulae (Xyloma) SA: 518 ← [DC 6: 159]
campanulaeformis (Agaricus) P: 239, sp. nov.
campanulata (Agaricus) Fr: 295, not 296 ← [BH: 431, pl. 552, fig. 1]
campanulata (Helvella fuliginosa var.) P: 257-258, nom. nov.†
campanulata (Peziza cerea var.) M: 25, var. nov.
campanulatus (Agaricus) M: 59, H: 24, P: 230-231, L: 473 ← [LSP: 1175]
campanulatus (Agaricus filopes var.) M: 63 ← [LSP: 1175 (Agaricus ______)]
campestris (Agaricus) Fr: 281, K: 17-18, P: 409, H: 21 ← [LSP: 1173]
campestris (Agaricus pratella) Z: 310† ← [LSP: 1173 (Agaricus ______)]
campestris (Agaricus edulis var.) M: 61 ← [LSP: 1173 (Agaricus ______)]
campestris (Pratella) G: 626 ← [LSP: 1173 (Agaricus)]
campestris, vaporarius (Agaricus [Pratella]) K: 19†
camphoratus (Agaricus) Fr: 218, sp. nov.
camphoratus (Agaricus) P: 193-194† ← [BH: 493, pl. 567 fig. 1]
canaliculata (Clavaria) Fr: 484 ← [FO 2: 294]
canaliculata (Clavaria) ENA: 213, sp. nov.
canaliculatus (Agaricus) Fr: 46, not 40 ← [Sae 2: 331]
candicans (Agaricus) Fr: 91 ← [PS: 456]
candicans (Omphalia) G: 613 ← [PS: 456 (Agaricus)]
candida (Aegerita) G: 546 ← [PD: 40]: Fr 3: 220
candida (Byssus) L: 466, SA: 525, M: 11 ← [HFA: 607]
candida (Himantia) Schl: 57, H: 35, LD 21: 162 ← [HFA: 607 (Byssus)]
candida (Solenia) Schl: 59 ← [HDF: p.f. pl. 8]
candidum (Byssocladium) G: 551 ← ["LM 7: 13"]
candidum (Coremium) G: 563 ← [PD: 40]
candidum (Fusidium) G: 544 ← [LM 3: 8]: Fr 3: 481
candidum (Geotrichum) LD 18: 445 ← [LM 3: 17]
candidum (Hydnum) Fr: 400 ← [SMH 1: 89]
candidum (Penicillium) G: 553 ← [LM 3: 17]: Fr 2: 409
candidum (Sporotrichum) G: 551 ← [LM 3: 13 ("Sporothichum")]
candidus (Agaricus) Fr: 249 ← [BEFC 1: 133]
candollianus (Agaricus) Fr: 296 ← [FO 2:.182]
caninus (Mucor) G: 561 ← [POM 1: 96]: Fr 3: 320
canobrunneus (Agaricus) Fr: 294, not 299 ← [BEFC 1: 133]
cantharelloides (Merulius) P: 392 ← [SEF: t. 47 (Agaricus) BH: 297, pl. 473 fig. 3 (Helvella)]
cantharellus (Agaricus) Schl: 56 ← [LSP: 1171 "chantarellus"]
cantharellus (Agaricus [Merulius]) K: 13-14 ← [LSP: 1171 (Agaricus "chantarellus")]
cantharellus (Merulius) SA: 556, H: 25, N&B: 332, R: 53, M: 47, P: 392, L: 471 ← [LSP: 1171 (Agaricus "chantarellus")]
caperatus (Agaricus) Fr: 241 ← [POM 1: 48]
capillaris (Agaricus) Fr: 160 ← [Sae 2: 268]
capitatum (Geoglossum hirsutum [var.]) H: 30, ?var. nov.
capitatus (Thamnomyces) E: 519 ← ["Link"]: Fr 3: index
capniocephalus (Agaricus) M: 71† ← [BH: 570, pl. 547, fig. 2]
capnoides (Agaricus) Fr: 289, nom nov.
caput-medusae (Hydnum) Fr: 409†, M: 37†, LD 22: 96† ← [BH: 210 "caput-medusae" (Clavaria)]
carbonaceum (Phacidium) FSS no. 210 ← ["Fries. Vetensk, Akad. Handl. 1817: 106"]: Fr 2: 574
carbonarium (Astoma) G: 524, sp. nov.
carbonarius (Agaricus) Fr: 252 ← [FO 2: 33]
carbonarius (Polyporus) Fr: 349, nom. nov.
cardarella (Agaricus) Fr: 84 ← ["Batt," polynomial]
caricinum (Leptostroma) FSS no. 176 ← [FO 2: 361 (Xyloma)]: Fr 2: 598
cariophyllea (Auricularia) M: 33-34 ← [BH: 284 "caryophyllea" ← Sch 4: 115 (Elvela "caryophyllaea")]

cariophyllea (Thelephora) SA: 542 ← [BH: 284 "caryophyllea (Auricularia) ← Sch 4: 115
(Elvela "caryophyllaea")]
carnea (Isaria) M: 13 ← [POM 1: 13, not 3]
carneum (Geoglossum) Fr: 490 ← [SS: 496]
carneum (Hydnum) Fr: 420 ← [FO 2: 268 (Sistotrema)]
carneus (Agaricus) Fr: 130, M: 74 ← [BH: 555, pl. 533, fig. 1]
carphosperma (Cytispora) FSS no. 155, sp. nov.: Fr 2: 543
carpinea (Sphaeria) Schl: 59 ← [SEF: pl. 376, "carpina"]
carpineus (Boletus) G: 641 ← [SEF: pl. 231]
carpini (Nemaspora) G: 532 ← [SEF: pl. 376, "carpina" (Sphaeria)]
carpini (Sclerotium pustullata var.) M: 130, ?var. nov.
carpini (Sphaeria) P: 286-287, M: 143 ← [SEF: pl. 376, "carpina"]
cartilaginea (Patellaria) G: 664 ← [Bolt: 101, pl. 101 (Peziza)]
cartilagineus (Agaricus) Fr: 46, M: 77 ← [BH: 596, pl. 589 fig. 2 "cartilaginosus" of index]
caryophyllea (Auricularia) P: 261 ← [BH: 284 ← Sch 4: 115 (Elvela "caryophyllaea")]
caryophyllea (Craterella, as "Cratella") G: 652 ← [Sch 4: 115 (Elvela "caryophyllaea")]
caryophyllea (Thelephora) Fr: 430, H: 29 ← [Sch 4: 115 (Elvela "caryophyllaea")]
caseus (Mucor) P: 502 ← [WSA 4: 396]
casispermum (Helmisporium) LD 20: 496 ← ["LM 3: ?"]
castanea (Sclerotium pustullata var.) M: 130, ?var. nov.
castaneae (Sphaeria) Schl: 59, ?sp. nov.: Fr 2: 525
castaneae (Sphaeria punctiformis var.) Schl: 59, ?var. nov.
castaneae (Xyloma) Schl: 60, ?sp. nov.
castaneaecola (Sphaeria lichenoides var.) M: 146, var. nov.
castaneus (Agaricus) Fr: 235, not 236, R: 38, P: 394, M: 82-83 ← [BH: 658, pl. 268]
castaneus (Boletus) Fr: 392, M: 45, SA: 554 ← [BH: 324, pl. 328]
castaneus (Polyporus) Fr: 369, nom. nov.
caudicina (Lepiota) G: 603 ← [PD: 19 (Agaricus)]
caudicinus (Agaricus) N&B: 310 ← [PD: 19]
caudicinus (Agaricus annularius var.) M: 85 ← [PD: 19 (Agaricus _______)]
caudicinus (Agaricus [Lepiota]) K: 10-11 ← [PD: 19 (Agaricus _______)]
caulicinalis (Agaricus) M: 79 ← [BH: 545, pl. 522, fig. 1]
cellare (Racodium) H: 34, G: 557-558 ← [PD: 43]
cellulariaeformis (Peziza) G: 666 ← [SEF: pl. 91, "cellularia"]
centrifugus (Agaricus) Fr: 222, sp. nov.
centro adfixus (Agaricus epixylon var.) M: 50†
centunculus (Agaricus) Fr: 262, sp. nov.
cepaestipes (Agaricus) M: 84 ← [SEF: pl. 2]
cepaestipes (Coprinus) G: 633 ← [SEF: pl. 2 (Agaricus)]
ceraceus (Agaricus) Fr: 102, H: 23 ← [WJ 2: 105]
ceraceus (Gymnopus) G: 607 ← [WJ 2: 105 (Agaricus)]
ceranoides (Clavaria) Fr: 481, with Sowerby as author, = C. rugosa ← [PS: 594]
ceranoides (Ramaria) G: 665 ← [PS: 594 (Clavaria)]
cerasi (Peziza) P: 264†, M: 20 ← [PD: 35]
cerasi (Hydnum) M: 37-38 ← [PS: 552 (Sistotrema) ← POM 2: 16 (Odontia)]
cerasi (Polyporus) Fr: 382 ← [PS: 552 (Sistotrema) ← POM 2: 16 (Odontia)]
cerato-sperma (Nemania) G: 518 ← [BH: 184 (Variolaria "ceratosperma")]
ceratosperma (Sphaeria) N&B: 297, Schl: 59, SA: 522-523, M: 142 ← [BH: 184 (Variolaria)]
cerea (Peziza) Re: 49, P: 461, M: 25 ← [BH: pl. 44, not p. 270]
cerebrina (Tremella) P: 176, M: 28, SA: 536 ← [BH: 221, pl. 386]
cereolus (Agaricus pratella) Z: 309† ← [Sch 4: 22]
cereus (Macroscyphus) G: 672 ← [BH: pl. 44, not p. 270 (Peziza)]
cernuus (Agaricus) Fr: 298, with Vahl as author ← [FD 17: 9, pl. 1008, fig. 1]
cernuus (Agaricus pratella) Z: 310† ← [FD 17: 9, pl. 1008, fig. 1 (Agaricus _______)]
cespititia (Amanita) R: 36 ← ["Dubois"]
cetratus (Agaricus) Fr: 207 ← [FO 2: 218]
cerussatus (Agaricus) Fr: 92, sp. nov.
cervinus (Agaricus) Fr: 82, "cerinus" of index ← [PS: 451 ← "Hoffmann. Nomenclator 119"]
chalybeus (Agaricus) Fr: 203, "chalybaeus" of index ← [PS: 343]

chalybeus (Gymnopus) G: 608 ← [PS: 343 (Agaricus)]
chama (Agaricus) Fr: 181, not 131 ← [Bosc: 85]
chamaeformis (Agaricus) Schl: 56, ?sp. nov.
chamissonis (Thamnomyces) E: 519, ?sp. nov. : Fr 3: index
chartacea (Thelephora) Fr: 437 ← ["Mey. Ess.: 305"]
chelidonicola (Sphaeria lichenoides var.) M: 146, var. nov.
chionea (Peziza) LD 20: 509† ← [?] : Fr 2: 132
chioneus (Polyporus) Fr: 359 ← [FO 1: 125]
chloranthus (Agaricus) Fr: 152 ← [FO 1: 156]
chlorophanus (Agaricus) Fr: 103, sp. nov.
chrisenterus (Agaricus) M: 74-75 ← [BH: 565, pl. 556, fig. 1, "chrysenteron"]
chrysenteron (Boletus) M: 45, SA: 555, R: 24 ← [BH: 328, pl. 490, fig. 3]
chrysenterus (Agaricus) Fr: 126 ← [BH: 565, pl. 556, fig. 1, "chrysenteron"]
chrysocoma (Hymenoscyphus) G: 674 ← [BH: 254, pl. 376, fig. 2 (Peziza)]
chrysocoma (Peziza) P: 462, M: 21-22, SA: 532 ← [BH: 254, pl. 376, fig. 2] : Fr 2: 140
chrysocoma (Peziza chrysocoma var.) M: 21 ← [BH: 254]
chrysodon (Agaricus) Fr: 32 ← [BEFC 2: 79]
chrysodon (Agaricus gymnopus) Z: 95† ← [BEFC 2: 79 (Agaricus ______)]
chrysoleucus (Agaricus) Fr: 167 ← [PS: 457]
chrysophyllus (Agaricus) Fr: 167, nom. nov.
chrysosperma (Cytispora) FSS no. 154 ← [PRNB 1: 82 (Sphaeria)]: Fr 2: 542
chrysosperma (Naemaspora) LD 22: 386, M: 148 ← [PRNB 1: 82 (Sphaeria)]
chrysosperma (Nemaspora) G: 532, SA: 524, Spr: 278† ← [PRNB 1: 82 (Sphaeria)]
chrysospermus (Mucor) P: 502 ← [BH: 99, pl. 504, fig. 1] : Fr 3: 438 (Sepedonium)
cibarium (Tuber) L: 485, R: 54, H: 10, N&B: 351, SA: 619, K: 39-40, G: 592 ← [BH: 74] : Fr 2: 290
cibarius (Cantharellus) Fr: 318, nom. nov.
cichoraceum (Erysiphe) M: 132-133 ← [DC 2: 274]
ciliaris (Coprinus) G: 633 ← [Bolt: 53, pl. 53 (Agaricus)]
ciliaris (Sphaeria) P: 493, LD 22: 386, SA: 524, M: 143 ← [BH: 173, pl. 468, fig. 1 (Hypoxylon)] : Fr 3: 355†
ciliata (Peziza) M: 21, SA: 531-532 ← [BH: 257, pl. 438, fig. 2]
ciliatula (Sphaeria) FSS no. 147, sp. nov.: Fr 2: 406
ciliatum (Engizostoma) G: 520 ← [PS: 35 (Sphaeria) ← POM 2: 67 (Sphaeria)] : Fr 2: 394
ciliatus (Polyporus) Fr: 349 ← [FO 1: 123]
cilicioides (Agaricus) Fr: 63, not 65, sp. nov.
cimicarius (Agaricus) P: 191-192 ← [BEFC 1: 22, 59, pl. 15]
cimicarius (Lactarius subdulcis [var.]) G: 625 ← [BEFC 1: 59 (Agaricus ______)]
cimmerius (Agaricus) Fr: 150, sp. nov.
cincinnatus (Agaricus) Fr: 256, nom. nov.
cinctulus (Agaricus) P: 229-230 ← [Bolt: 152, pl. 152]
cinctulus (Coprinus) G: 633 ← [BH: 152, pl. 152 (Agaricus)]
cinerea (Auricularia) M: 35, as sp. nov. ← [PS: 579 (Thelephora) ← PD: 31 (Corticium)]
cinerea (Auricularia cariophyllea var.) M: 33 ← [BH: 284]
cinerea (Auricularia papyrina var.) M: 35 ← [BH: 280]
cinerea (Auricularia reflexa var.) M: 34 ← [BH: 282]
cinerea (Botrytis) N&B: 367 ← [PD: 40, "cinerascens", :47 as "cinerea"] : Fr 3: 396
cinerea (Cerrena) G: 649 ← [PS: 551 (Sistotrema) ← PD: 29 (Sistotrema)]
cinerea (Clavaria) Fr: 468, M: 32, L: 468 ← [BH: 204, pl. 354]
cinerea (Cortinaria) G: 628 ← [PS: 279 "violaceo-cinereus" ← PC: 2 "violaceo-cinereus" ← Sch 4: 2 "violaceus"]
cinerea (Daedalea) Fr: 336 ← [FO 1: 105]
cinerea (Morchella esculenta var.) M: 90 ← [BH: 274]
cinerea (Octospora) G: 667 ← [PS: 634 (Peziza) ← BEFC 1: 197 (Peziza)]
cinerea (Peziza) M: 20, P: 463 ← [BEFC 1: 197] : Fr 2: 142
cinerea (Peziza imberbis var.) M: 22-23 ← [BH: 245]
cinerea (Ramaria) G: 656 ← [BH: 204 (Clavaria)]
cinerea (Thelephora) Fr: 453, not 435 ← [PD: 31 (Corticium)]
cinerescens (Agaricus) M: 76-77, SA: 580 ← [BH: 598, pl. 428 fig. 2]
cinereum (Hydnum) Fr: 404, M: 38 ← [BH: 309, pl. 419]

cinereum (Xyloma) M: 150 ← [A&S: 61 (Xyloma pini [var.] ______)]
cinereus (Agaricus) Fr: 310, with Bulliard as author ← [BH: index, not 398]
cinereus (Agaricus) P: 233†, P: 419, L: 472, M: 56, H: 24 ← [Sch 4: 44]
cinereus (Agaricus coprinus) Z: 110† ← [Sch 4: 44 (Agaricus ______)]
cinereus (Cantharellus) Fr: 320 [PD: 26]
cinereus (Coprinus) G: 634 ← [Sch 4: 44 (Agaricus)]
cinereus (Merulius hydrolips var.) M: 48 [PID: 10]
cinnabarina (Aegerita) M: 15 ← [PS: 697 (Dematium)]
cinnabarina (Gyraria) G: 595 ← [BH: 218 (Tremella)]
cinnabarina (Torula) Schl: 60 ← ["Mart."]
cinnabarina (Tubercularia) M: 129 ← [BH: 218 (Tremella)] : Fr 2: 233?
cinnabarinus (Agaricus araneosus var.) M: 82, SA: 583 ← [DC 2: 198]
cinnabarinus (Coniocarpon) Re: 48 ← [LDC: 68]
cinnabarinus (Polyporus) Fr: 371 ← [JFA 4: 2]
cinnamomea (Strilia) G: 645 ← [JOB: 116 (Boletus)]
cinnamomeus (Agaricus) H: 22, P: 220 ← [LSP: 1173]
cinnamomeus (Agaricus cinnamomeus [var.]) Fr: 229 ← [LSP: 1173, (Agaricus ______)]
cinnamomea (Cortinaria) G: 630 ← [LSP: 1173 (Agaricus)]
circeus (Agaricus) SA: 576† ← [BH: 523, "criceus"]
circinnata (Amanita) G: 600 ← [PS: 255 (Amanita rubescens [var.] ______)]
circumvallatum (Astoma) G: 525 ← [SEF: pl. 373 (Sphaeria)]
cirrhatum (Hydnum) Fr: 411 ← [PD: 29, "cirratum"]
citrina (Amanita) G: 599, R: 47 ← [Sch 4: 11 (Agaricus)]
citrina (Calycina) G: 670 ← [PD: 34 (Peziza) ← "Hedwig. Musc. 28, t. 8, fig. B"]
citrina (Peziza) P: 457 ← [PD: 34 ← "Hedwig. Musc. 28, t. 8, fig. B"] : Fr 2: 131
citrinellus (Agaricus) Fr: 155 ← [PID: 44]
citrinus (Boletus) G: 643 ← [PS: 524 ← "Plan. Fung. Erfurt 26"]
clandestina (Peziza) M: 23, SA: 533 ← [BH: 251, pl. 416, fig. 5] : Fr 2: 94
clandestinus (Agaricus) Fr: 206 ← [FO 2: 166]
clathroides (Hydnum) Fr: 409, with Bulliard as author ← [PRR 2: an. p. 51]
clavariae formis (Tremella) LD 20: 140† ← [?, not validly published]
clavata (Sphaeria) SA: 523, LD 22: 386, M: 142-143 ← [BH: 171, pl. 444, fig. 4 (Hypoxylon)]
clavatum (Coryne) G: 595 ← [PCC: 90 (Acrospermum)]
clavatus (Cantharellus) Fr: 322, nom. nov.
clavatus (Gomphus) G: 638 ← [PS: 498 (Merulius) ← POM 1: 21 (Merulius)]
clavicularis (Agaricus) Fr: 158, sp. nov.

claviformis (Merulius) LD 19: 194†
claviformis (Mycena) G: 621 ← [HFA: 622, "clavus" (Agaricus)]
claviformis (Sphaeria) P: 279, G: 529 ← [SEF: pl. 337]
clavipes (Agaricus) Fr: 86 ← [PS: 353]
clavus (Agaricus) Fr: 134, with Bulliard as author ← [BH: pl. 148 "clavis" ← ← LSpPl: 1644]
clavus (Agaricus) L: 474, SA: 572, N&B: 318, H: 21, M: 65, P: 236-237 ← ← [LSpPl: 1644]
clavus (Sclerotium) M: 129-130, FBR: 43, SA: 618, N&B: 303 ← [DC 6: 115 ← "Bibl. Banks 3: 429"]
clypeatus (Agaricus) H: 22 ← [LSP: 1174]
clypeolarius (Agaricus) Fr: 21, H: 23, M: 86, N&B: 309, P: 420-421, SA:587, HFD: 12, pl. 1732, fig. 1, R: 39 ← [BH: 482, pl. 506, fig. 2; pl. 405]
coccinea (Cucurbitaria) G: 519 ← [PS: 49 (Sphaeria) ← PID: 47 (Sphaeria)]
coccinea (Peziza) N&B: 347, P: 458, SA: 533-534, M: 24-25 ← [Sch 4: 100 (Elvela)]
coccinea (Sphaeria) Schl: 59, FSS no. 183, H: 7 ← [PS: 49 (Sphaeria) ← PID: 47 (Sphaeria)] : Fr 2: 412
coccinea (Thelactis) MNA: 509, sp. nov.
coccineus (Agaricus) Fr: 105, not 108, with Wulfen as author ← [DC 2: 186 ← Sch 4: 70]
coccineus (Agaricus) L: 474, M: 76, SA: 579-580 ← [DC 2: 186 ← Sch 4: 70]
coccineus (Agaricus gymnopus) Z: 97† ← [WJ 2: 106 (Agaricus ______)]
coccineus (Boletus) M: 40, SA: 549 ← [BH: 364, pl. 501, fig. 1)]
coccineus (Clavaria) P: 476-477 ← [SEF: pl. 294]
coccineus (Macroscyphus) G: 672 ← [Sch 4: 100 (Elvela)]

cochleata (Omphalia) G: 612 ← [PD: 22 (Agaricus) ← "Abbild. d. Schwämme 3"]
cochleata (Peziza) P: 461-462, M: 26†, L: 467, SA: 534 [LSP: 1181] : Fr 2: 50†
cochleata (Peziza) N&B: 348 ← [LDC: 18]
cochleatus (Agaricus) Fr: 177 ← [PD: 22 ← "Abbild. d. Schwämme 3"]
cochleatus (Agaricus (Omphalia)) K: 15 ← [PD: 22 (Agaricus ______) ← "Abbild. d. Schwämme 3"]
coeruleus (Agaricus Gymnopus) Z: 96†
coffeatus (Agaricus) Fr: 85, sp. nov.
cohaerens (Agaricus) Fr: 253 ← [PS: 306]
cohaerens (Sphaeria) Schl: 59, N&B: 296 ← [PD: 2] : Fr 2: 333.
collariatum (Micromphale) G: 622 ← [With: 148 (Merulius)]
collariatus (Merulius) H: 25, P: 390 ← [With: 148]
collematiformis (Tremella) Schl: 60, ? sp. nov.
collinita (Cortinaria) G: 628 ← [SEF: pl. 9 (Agaricus)]
collinitus (Agaricus) Fr: 248, P: 181-182 ← [SEF: pl. 9]
collinus (Agaricus) Fr: 124 ← [Sch 4: 52, not Scopoli (polynomial)]
collinus (Agaricus gymnopus) Z: 91† ← Sch 4: 52 (Agaricus ______)]
collinus (Gymnopus) G: 607 ← [Sch 4: 52 (Agaricus)]
colubrina (Lepiota) G: 601-602 ← [PS: 258 (Agaricus)]
colubinus (Agaricus) M: 86 ← [BH: 484, pl. 583]
columbarius (Agaricus) M: 78 [BH: index]
columbetta (Agaricus) Fr: 44, nom. nov.
colus (Agaricus) P: 221 (P: 422) ← [With 4: 282]
comata (Sphaeria) M: 144-145 ← [TM 2: 15] : Fr 2: 504
comatus (Agaricus coprinus) Fr: 307†, with Müller as author ← [Schmidel, ic.: 42, pl. 10]
comatus (Agaricus coprinus) Z: 108† ← [PD: 62 (Coprinus)]
comatus (Coprinus) G: 633-634 ← [PD: 62]
comedens (Thelephora) Fr: 447 ← ["Nees Syst. 239"]
comitialis (Agaricus) Fr: 86 ← [PS: 352]
commune (Schizophyllum) Fr: 330, nom. nov.
communis (Agaricus fistulosus var.) M: 63, var. nov.
communis (Boletus) P: 242 ← [SEF: p. f. pl. 225 ← BH: index†]
communis (Sphaeria) G: 528 ← [SEF: pl. 295]
commutatum (Phacidium) FSS no. 164, ? sp. nov. (not in Syst. Mycol.)
compactum (Hydnum) Fr: 402, LD 22: 94 ← [PC 2: 57]
compactum (Sclerotium) FBR: 45, M: 130 ← [DC 6: 112] : Fr 2: 258
compactus (Agaricus) Fr: 290 ← [Sae 2: 285]
complanata (Sphaeria) M: 146 ← [DC 2: 299] : Fr 2: 508
complanata (Sphaeria herbarum [var.] H: 7 ← [DC 2: 299 (Sphaeria ______)]
complanatum (Sclerotium) G: 592 ← [TM: 5] : Fr 2: 248
composita (Nemaspora) G: 532 ← [SEF: pl. 237 (Sphaeria)]
compressa (Clavaria tomentosa var.) M: 33, var. nov.
compressa (Peziza) Schl: 58 ← [PD: 35] : Fr 2: 152
compressa (Rhizomorpha fragilis var.) M: 136, var. nov.
compressa (Sphaeria) G: 531 ← [PS: 56, not 54] : Fr 2: 470
compressus (Agaricus) Fr: 115, P: 413 ← [With III 3: 354]
compressus (Gymnopus) G: 610 ← [With III 3: 354 (Agaricus)]
concava (Sphaeria) P: 494 ← [SEF: pl. 317]
concavum (Astoma) G: 526 ← [SEF: pl. 317 (Sphaeria)]
concentrica (Sphaeria) H: 4, FSS no. 141 ← [Bolt: 180, pl. 180]
concentrica (Thelephora) Fr: 446 ← [A&S: 279]
concentricum (Peripherostoma) G: 513 ← [Bolt: 180, pl. 180 (Sphaeria)]
concentricum (Xyloma) P: 316-317, N&B: 302 ← [POM 2: 101] : Fr 2: 331 (Sphaeria)
conchata (Thelephora) Fr: 438, sp. nov.
conchatus (Agaricus) Fr: 181, P: 239 (P: 429) ← [BH: index†]
conchatus (Agaricus inconstans var.) M: 51 ← [BH: index† (Agaricus ______)]
conchatus (Agaricus inconstans [var.]) SA: 561 ← [BH: index† (Agaricus ______)]
conchatus (Boletus) M: 41 ← [POM 1: 24]
conchatus (Polyporus) Fr: 376 ← [POM 1: 24]
concinnus (Polyporus) Fr: 350 ← [PFO 1: 73]

confertus (Prunulus) G: 631 ← [Bolt: 18, pl. 18 (Agaricus)]
confluens (Agaricus) Fr: 123 ← [POM 1: 8]
confluens (Agaricus gymnopus) Z: 95† ← [POM 1: 8 (Agaricus ______)]
confluens (Peripherostoma) G: 514, sp. nov.
confluens (Polyporus) Fr: 355, not 358 ← [A&S: 244 (Boletus)]
confluens (Sclerotium) M: 131, nom. nov.
confluens (Sistotrema) Fr: 426, G: 649 ← [PD: 28]
confluens (Thelephora) Fr: 447 ← [FO 1: 152]
confluens (Tubercularia) H: 9, M: 129, Schl: 60 ← [PS: 113]
confluens (Xyloma acerina [var.]) G: 545, var. nov.
confluens (Xyloma salicinum [var.]) G: 545, var. nov.
confragrosa (Daedalea) Fr: 336, G: 638, P: 249-250 ← [Bolt: 160, pl. 160]
congregatus (Agaricus) P: 232†, (P: 235, 422), H: 23 ← [With 4: 280]
congregatus (Agaricus) N&B: 321, M: 57, L: 473, SA: 568 ← [BH: index†]
conica (Sphaeria) Spr: 279 ← [TM 2: 43] : Fr 2: 538 (Sphaeronema)
conicum (Relhanum) G: 661 ← [PS: 613 ← "Timm, Fl. Megap.: 263"]
conicus (Agaricus) Fr: 103, not 105, N&B: 315, R: 50 ← [Sch 4: 2, not Scopoli (Polynomial)]
conicus (Agaricus gymnopus) Z: 96† ← [Sch 4: 2 (Agaricus ______)]
conicus (Agaricus filopes var.) M: 63 ← [DC: 161]
conigenum (Hypoderma) M: 152 ← [PS: 102 (Hypoderma) ← POM 1: 30 (Hysterium)]
conigenus (Agaricus) Fr: 132 ← [PS: 388]
conjunctum (Circinostoma) G: 521 ← ["Nees Syst. 80" (Sphaeria)]
connata (Coltricia) G: 644, nom. nov.
connatum (Hydnum) Fr: 405 ← [SS: 491]
connatus (Agaricus) Fr: 97 ← [Sae 2: 299]
conocephalus (Agaricus) Fr: 304, M: 58-59 ← [BH: 449, pl. 563, fig. 1]
conopilus (Agaricus) Fr: 504, sp. nov.†
conopus (Agaricus) Fr: 219 ← [PS: 285]
consobrinus (Agaricus) Fr: 60 ← [FO 2: 195]
conspersum (Cenangium) FSS no. 171 ← ["Fries. Vetensk. Akad. Handl. 1817: 112"] Fr 2: 175.
conspersus (Agaricus) Fr: 260 ← [PID: 50]
conspersus (Agaricus) P: 234, 419 ← [With 4: 293]
constrictum (Leccinum) G: 647 ← [PS: 508 (Boletus)]
constrictus (Agaricus) Fr: 28, not 38, sp. nov.
contiguus (Agaricus) SA: 574, N&B: 328, M: 68, P: 398 ← [BH: 518, pl. 576, fig. 2; pl. 240]
contiguus (Boletus) Re: 51 ← [PS: 544]
contiguus (Polyporus) Fr: 378 ← [PS: 544 (Boletus)]
contorta (Clavaria) Fr: 478 ← [HBR 1: 29]
contorta (Phlebia) Fr: 427, not 417, sp. nov.
contortus (Agaricus) Fr: 122, M: 76, SA: 579 ← [BH: table of figs., not 612]
controversus (Agaricus) Fr: 62, R: 30 ← [PS: 430 (Agaricus lactifluus ______) ← POM 2: 39 (Lactarius ______)]
convallariae (Xyloma) Schl: 60, sp. nov. ?
convallariaecola (Sphaeria lichenoides var.) M: 146, var. nov.
convergens (Circinostoma) G: 521 ← [TM 2: 39 (Sphaeria)] : Fr 2: 410
convolvuli (Erysibe) G: 589 ← [DC 2: 274 (Erysiphe) ← LDC: 57]
convolvuli (Erysiphe) M: 133, SA: 615 ← [DC 2: 274 ← LDC: 57]
convolvulicola (Sphaeria lichenoides var.) M: 146, var. nov.
coprinus (Agaricus) Fr: 279 ← [FO 2: 2 (Amanita)]
coprophilus (Agaricus) Fr: 297, M: 58 ← [BH: 423, pl. 566, fig. 3]
copulatus (Agaricus) Fr: 504, E: 519, Spr: 310 ← [EHor: 86]
coralloides (Clavaria) Fr: 467, P: 269, 474-475, H: 29, SA: 540, L: 468, N&B: 343, M: 32, Schl: 56 ← [LSP: 1182]
coralloides (Hericium) G: 652 ← [Sch 4: 95 (Hydnum), not Scopoli (Polynomial)]
coralloides (Hydnum) Fr: 408, LD 22: 96, N&B: 342, P: 450 ← [Sch 4: 95]
coralloides (Thelephora) Fr: 432, nom. nov.
coreacea (Tremella) Schl: 60, sp. nov. ?
coriacea (Clavaria) M: 33 ← [BH: 198, pl. 452, fig. 2]
coriacea (Peziza) M: 19 ← [BH: 258, pl. 438, fig. 1] : Fr 2: 159†
coriacea (Ramaria, as "Ramalaria") G: 656 ← [BH: 198, pl. 452, fig. 2 (Clavaria)]

coriacea (Sphaeria) G: 528 ← [SEF: pl. 371, fig. 1]
coriaceum (Merisma) N&B: 343 ← [LDC: 21 (Clavaria) ← BH: 198, pl. 452, fig. 2]
coriaceus (Agaricus) M: 50, N&B: 332, L: 471, SA: 559 ← [BH: 373, pl. 537, 394]
coriaceus (Apus) G: 617 ← [BH: 373, pl. 394, 537 (Agaricus)]
cornea (Auricularia) Spr: 310 ← [EHor: 91]
cornea (Clavaria) Fr: 486, P: 473, H: 30 ← [BEF: 139]
cornea (Corynoides) G: 654 ← [BEF: 139 (Clavaria)]
cornea(Tremella) Schl: 60, sp. nov. ?
cornicola (Sphaeria lichenoides var.) M: 146, var. nov.
corniculata (Clavaria) Fr: 471, ENA: 218 ← [Sch 4: 117]
corniculata (Ramaria) G: 655 ← [Sch 4: 117 (Clavaria)]
corniculata (Sphaeria) H: 6, Schl: 59 ← ["Ehrenberg. Pl. Crypt. Dec. 30, no. 300"] : Fr 2: 384
corniculatum (Engizostoma) G: 520 ← ["Ehrenberg. Pl. Crypt. Dec. 30, no. 300" (Sphaeria)]
cornucopioides (Agaricus) P: 189-190 ← [Bolt: 8, pl. 8]
cornucopioides (Cantharellus) Fr: 321, G: 636-637 ← [PS: 491 (Merulius) ← LSP: 1181 (Peziza)]
cornucopioides (Merulius) M: 48, L: 471 ← [PS: 491 (Merulius) ← LSP: 1181 (Peziza)]
cornucopioides (Omphalia cochleata [var.]) G: 612 ← [Bolt: 8, pl. 8 (Agaricus ______)]
cornucopioides (Peziza) Schl: 58, P: 465† ← [PS: 491 (Merulius) ← LSP: 1181 (Peziza)]
cornuta (Hypoxylon cornutum var. Sphaeria ______) M: 137-138†
cornuta (Sphaeria) SA: 520, L: 485-486 ← [BH: 193 ← "Hoffmann, Crypt. II, pl. 3, fig. 1, fasc. 1"]
cornutum (Hypoxylon) G: 512 ← [BH: 193 ← "Hoffmann, Crypt., II, pl. 3, fig. 1, fasc. 1" (Sphaeria)]
cornutum (Hypoxylon) M: 137-138, sp. nov. ?
cornutum (Sclerotium) FBR: 44, in obs.† ← [?]
coronata (Peziza) M: 23 ← [BH: 251, pl. 416, fig. 4] : Fr 2: 120
coronata (Sphaeria) P: 489, M: 142 ← [With: 394 ← "Hoffmann, Pl. Crypt. fasc. 1, pl. 5, figs. 4, 5"] : Fr 2: 395
coronatum (Phacidium) FSS no. 165 ← [Sae 2: 437 (Ascobolus)] : Fr 2: 577
coronatum (Phacidium) Schl: 58† ← ["K"]
coronilla (Agaricus) M: 84 ← [BH: 633, pl. 597, fig. 1]
coronillae (Corynium) Schl: 57, sp. nov. ?
coronillus (Agaricus) Fr: 282 ← [BH: 633, pl. 597, fig. 1]
corrugatum (Hydnum) Fr: 414 ← [FO 2: 269]
corrugis (Agaricus) Fr: 298 ← [PD: 24]
corticalis (Agaricus) N&B: 318, M: 65 ← [BH: 475, pl. 519, fig. 1]
corticalis (Agaricus) P: 213 (211†), stat. nov.
corticalis (Auricularia) P: 455, M: 35 ← [BH: 285, pl. 436]
corticalis (Peziza) M: 22 ← [PD: 33] : Fr 2: 96
corticalis (Rhizomorpha) P: 306-307, sp. nov.
corticalis (Sphaeria) P: 281-282 ← [With 4: 394]
corticalis (Sphaeria byssiseda var.) M: 144, var. nov.
corticalis (Thelephora) L: 469, SA: 543-544 ← [BH: 285, pl. 436 (Auricularia)]
corticatus (Agaricus) Fr: 179 ← [FO 1: 92]
corticisedum (Hysterium octraceum var.) M: 153, var. nov.?
corticola (Agaricus) Fr: 159 ← [PS: 394 "corticalis" ← BH: 475 "corticalis"]
corticola (Mycena) G: 621 ← [BH: 475, pl. 519, fig. 1 (Agaricus "corticalis")]
corticola (Polyporus) Fr: 385, sp. nov.
coruscans (Agaricus) Fr: 227, sp. nov.
corylaria (Sphaeria punctiformis var.) M: 146, var. nov.: Fr 2: 525
corylea (Sclerotium erysiphe [var.]) H: 10 ← [LDC: 57 (Erysiphe ______)]
coryli (Erysiphe) Re: 55, SA: 614, M: 131 ← [LDC: 57]
coryli (Peziza) Schl: 58, sp. nov.?
coryli (Sphaeria) FSS no. 201 ← [BEFC 2: 131] : Fr 2: 436
coryli (Sphaeria fusca var.) M: 139 ← [DC 2: 287 (Sphaeria ______)]
coryli (Thelephora) Schl: 59, sp. nov.?
cotini (Hypoderma xylomoides var.) M: 152, var. nov. ?†

cotini (Hysterium) Schl: 58, sp. nov. ?
cotini (Sphaeria) Schl: 59, sp. nov. ?
cotoneastris (Xyloma) Schl: 60, sp. nov. ?
crampylus (Agaricus) Fr: 65 ← ["Otto, Ag. 67"]
craspedius (Agaricus) Fr: 187, nom. nov.
crassa (Isaria) G: 562 ← [PHC: 231]
crassipes (Agaricus) P: 199, 400, H: 20 ← [Sch 4: 38]
crassipes (Agaricus araneosus var.) SA: 583, M: 82 ← [DC 2: 198]
crassipes (Morchella) M: 90-91 ← [PS: 621 ← "Ventenat, Mem. Inst. Nat., France 1: 509" (Phallus)] : Fr 2: 9
craterium (Sphaeria) M: 145-146 ← [DC 2: 298]
crenata (Peziza) M: 25 ← [BH: 261, pl. 396, fig. 3]
crenatus (Agaricus mammosus var.) P: 219 ← [WSA 3: 248 (Agaricus ______)]
crenulatus (Agaricus) Fr: 112 ← [Sae 2: 293]
cretaceus (Agaricus) Fr: 95, not 195† ← [PS: 369]
cretaceus (Agaricus) Fr: 280†, P: 211-212, SA: 585, SB no. 594, pl. 594, fig. 2 ← [BH: 636, pl. 374]
cretaceus (Agaricus cepaestipes var.) M: 84 ← [DC 2: 202 ← BH: 636, pl. 374 (Agaricus ______)]
cretaceus (Coprinus cepaestipes [var.]) G: 633 ← [DC 2: 202 (Agaricus cepaestipes var. _____) ← BH: 636, pl. 374 (Agaricus ______)]
crinata (Peziza) M: 21 ← [BH: 249, "crinita"] : Fr 2: 89
crinitus (Agaricus) Fr: 175 ← [LSpPl: 1644]
crinitus (Polyporus) Fr: 362 ← ["Sprengel, Vetensk. Akad. Handl. 1820: 51"]
criptarum (Byssus) L: 466 ← [LFF 1: 102, as alga, "cryptarum"]
crispa (Peziza) P: 468 ← [SEF: pl. 427, "425"]
crispa (Sparassis) Fr: 465 ← [WJ 2: 100 (Clavaria)]
crispa (Thelephora) Fr: 437 ← [PS: 568]
crispatus (Merulius) Fr: 328 ← [FD 12: 6, pl. 716, fig. 2†, polynomial]
crispula (Clavaria) Fr: 470, sp. nov.
crispum (Hydnum) Fr: 415 ← [Sch 4: 97, not 98]
crispum (Hypoderma) SA: 516, G: 509 ← [PS: 101 (Hysterium)]
crispus (Cantharellus) Fr: 323, HFD: 13 ← [PD: 26 as "Cantarellus"]
crispus(Merulius) M: 49, Schl: 58 (as "Meruleus") ← [PD: 26 (Cantharellus, as "Cantarellus")]
crispus (Polyporus) Fr: 363 ← [PS: 529 (Boletus adustus var. _____) ← POM 2: 8 (Boletus ______)]
cristata (Clavaria) Fr: 473 ← [HBR 1: 92]
cristata (Grifola) G: 643 ← [Sch 4: 93 (Boletus)]
cristata (Lepiota colubrina [var.]) G: 602 ← ["Willdenow, Berol. 1104" (Agaricus ______)]
cristata (Sphaeria) Spr: 278, G: 531 ← [PS: 54, not 56]
cristata (Thelephora) Fr: 434 (with Fries as author) ← [PCC: 228 (Merisma, not Merulius)]
cristatum (Merisma) G: 653 ← [PCC: 228]
cristatus (Agaricus) Fr: 22† (with Batsch as author) ← [Bolt: 7, pl. 7]
cristatus (Polyporus) Fr: 356 ← [Sch 4: 93 (Boletus)]
cristulatum (Hydnum) Fr: 422, sp. nov.
crocatus (Agaricus) Fr: 148 ← [Schr: 126]
crocea (Clavaria) Fr: 472, Schl: 56 ← [PIC: 36]
crocea (Cortinaria) G: 630 ← [BEF: 71, (Agaricus "crocatus") ← Sch 4: 3, (Agaricus "croceus")]
crocea (Naemaspora) M: 148, Re: 48, Schl: 58 (as "Nemospora") ← [POM 1: 81] : Fr 3: 479
croceocaeruleus (Agaricus) Fr: 238 ← [PS: 341 "croceo-coeruleus" ← PID: 2 "croceo-caeruleus"]
croceofulvus (Agaricus) Fr: 214 ← [DC 6: 49, "croceo-fulvus"]
croceus (Agaricus) M: 78-79, L: 474, SA: 581 ← [BH: 553, pl. 524, fig. 3; pl. 50]
croceus (Agaricus) P: 197-198 (405) ← [Bolt: 51, pl. 51, fig. 2]
croceus (Polyporus) Fr: 364 ← [POM 1: 87 (Boletus)]
crocorum (Rhizoctonia) M: 134-135 ← [PS: 119 (Sclerotium)] : Fr 2: 265
crocorum (Sclerotium) FBR: 43 ← [PS: 119]

crocorum (Thanatophytum) G: 590 ← [PS: 119 (Sclerotium)]
cruciferarum (Albugo) G: 540 ← [LDC: 49 (Uredo)]
crucigerus (Agaricus) SA: 577-578, sp. nov.†
cruenta (Sphaeria) Schl: 59 ← [Kunze?] : Fr 2: 531
cruenta (Thelephora) Fr: 444, HFD: 13† ← [PS: 575]
cruenta (Tremella) P: 512, H: 32† ← [SEB 25: p.f. pl. 1800]
cruentus (Agaricus) Fr: 149, sp. nov.
cruentus (Hypochnus) Schl: 58 ← [SEB: p.f. pl. 1800 (Tremella)]
crustacea (Aegerita) M: 15, SA: 528 (as "Egerita") ← [DC 2: 72 ← BH: 100, pl. 504, fig. 2 (Mucor)]
crustacea (Nemania) G: 517 ← [SEF: pl. 372, fig. 11]
crustacea (Thelephora) Fr: 450 ← [Sae 2: 396]
crustosum (Hydnum) Fr: 419 ← [POM 2: 16 (Odontia)]
crustuliniformis (Agaricus) P: 196, M: 78, SA: 581 ← [BH: 589, pl. 308, 546]
cryptarum (Boletus) SA: 547, M: 39, L: 470 ← [BH: 350, pl. 478]
cryptarum (Byssus) SA: 526, M: 12 ← [LFF 1: 102, as alga]
cryptarum (Polyporus) Fr: 376 ← [BH: 350, pl. 478 (Boletus)]
cryptarum (Poria) G: 639 ← [BH: 350, pl. 478 (Boletus)]
crysantheron (Boletus) N&B: 334 ← [LDC: 26, "chrysenteron"]
crystallinus (Pilobolus) M: 128, H: 9-10, G: 562 ← [WH: 110 (Hydrogera)] : Fr 2: 308
cucullatus (Agaricus) Fr: 158 ← [PS: 372]
cucumis (Agaricus) Fr: 231 ← [POM 1: 45]
cuneifolius (Agaricus) Fr: 116 ← [FO 2: 99]
cupressiforme (Hypoxylon cornutum [var.]) G: 512 ← [WBA 3: 457 (Clavaria ______)]
cupularis (Agaricus) Fr: 269, M: 66 ← [BH: 529, pl. 554, fig. 2]
cupularis (Cantharellus) Fr: 325 ← [WFL: 529 (Merulius)]
cupularis (Cucurbitaria) G: 519 ← [POM 1: 65 (Sphaeria)] : Fr 2: 416
curtipes (Agaricus) Fr: 88, sp. nov.
curvirostra (Sphaeria) G: 530 ← [SEF: pl. 373, fig. 5] : Fr 2: 507
cuspidata (Prunulus gracilis [var.]) G: 631 ← [Bolt: 66, pl. 66, fig. 2 (Agaricus ______)]
cuticularis (Boletus) Re: 51, P: 445, M: 42 ← [BH: 350, pl. 462]
cuticularis (Polyporus) Fr: 363 ← [BH: 350, pl. 462 (Boletus)]
cuticulosa (Peziza) P: 263 ← [Dick 3: 22]
cyana (Cortinaria) G: 627 ← [PS: 276, not Sch]
cyanescens (Boletus) Fr: 395, M: 45, SA: 554 ← [BH: 329, pl. 369]
cyaneus (Agaricus) M: 60-61 ← [BH: 641, pl. 170, 530, fig. 1]
cyanocephalus (Mucor) MNA: 505, sp. nov. : Fr 3: 324
cyanoxanthus (Agaricus) N&B: 327 ← [PS: 445, "Agar. russ. cynoxanthus" ← Sch 4: 40]
cyanoxanthus (Agaricus [Russula]) K: 19-20 ← [PS: 445, "Agar. russ. cynoxanthus" ← Sch 4: 40]
cyathiforme (Hydnum) Fr: 405 ← [BH: 308 ← Sch 4: 93]
cyathiforme (Hydnum) SA: 545-546, LD 22: 94, M: 38 ← [Sch 4: 93]
cyathiformis (Agaricus) Fr: 173 ← [BH: 512, pls. 575, 568, fig. 1 (not pl. 248)]
cyathiformis (Agaricus) P: 207 ← [BH: 512, pl. 568, fig. 1 (not pls. 575, 248)]
cyathiformis (Agaricus) M: 67-68, P: 182-183 ← [BH: 512, pl. 248 (not pls. 568, 575)]
cyathiformis (Agaricus) SA: 574 ← [BH: 512, pls. 248, 575, 568, fig. 1]
cyathoidea (Peziza) M: 23 ← [LSP: 1181 "cyathoides"]
cyathoides (Omphalia) G: 614 ← [Bolt: 145, pl. 145 (Agaricus) ← BH: 512, "cyathiformis"]
cyathoides (Peziza) P: 264-265 ← [LSP: 1181]
cyathoideus (Hymenoscyphus) G: 674 ← [LSP: 1181 (Peziza)]
cyatiformis (Agaricus) N&B: 329 ← [BH: 512, "cyathiformis"]
cylindrica (Clavaria) SA: 538-539, M: 30-31 ← [BH: 212, pl. 463, fig. 1]
cylindrica (Clavaria) P: 472, G: 656 ← [SEF: pl. 90 ← BH: 212, pl. 463, fig. 1]
cylindrica (Clavaria lutea var.) M: 31 ← [BH: 212, pl. 463, fig. 1 (Clavaria cylindrica var. lutea)]
cylindrica (Xylaria albicans [var.]) G: 511 ← [SEF: pl. 90 (Clavaria ______) ← BH: 212, pl. 463, fig. 1 (Clavaria ______)]
cylindricum (Astoma) G: 523 ← [TM 2: 42 (Sphaeria)] : Fr 2: 538 (Sphaeronema)
cylindricus (Agaricus) P: 423 (232-233†), H: 23 ← [Sch 4: 5]
cynoxanthus (Agaricus russula) Z: 352† ← [PS: 445, not PCS: 37, not Sch]
cyparissiae (Sclerotium) SA: 618, FBR: 45 ← [DC 6: 114] : Fr 2: 256

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BOOK REVIEWS

by

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INTRODUCTION TO BRITISH LICHENS, par Ursula K. DUNCAN, lxxiv + 292 p., 128 figs., 15 × 22 cm, toilé. Arbroath, T. Bunde & Co., distribué par The Richmond Publishers, Orchard Road, Richmond, Surrey, U.K., 1970. £ 4.00.

Conçu sur le modèle de la flore bien connu de A. L. Smith "A monograph of the British Lichens" (2e éd. 1918 & 1926), le livre de U. Duncan est une mise à jour utile de 65% de la flore lichénique de Grande Bretagne. Les 900 espèces, variétés et formes décrites ont été choisies pour leur fréquence et leur intérêt taxonomique et écologique.

En présentant cette flore abrégée, l'auteur a destiné son ouvrage aux non-spécialistes.

Cette flore s'écarte aussi de celle de A. L. Smith par l'arrangement taxonomique qui, selon la conception moderne proposée par Santesson en 1952 et adoptée par Hale en 1967, intègre les ascolichens dans la classification des Ascomycètes, les départageant entre les Ascomycetidae à asques unituniquées et les Loculoascomycetidae à asques bituniquées. Une table de correspondence de l'ancienne classification à la nouvelle eut certainement aidé l'utilisateur moins averti.

INDEX HERBARIORUM, A GUIDE TO THE LOCATION AND CONTENTS OF THE WORLD'S PUBLIC HERBARIA, édite par F. A. STAFLEU, publié par l'I.A.P.T., Intern. Bureau for Plant Taxonomy and Nomenclature, par Oosthoek, Scheltema & Holkema, Emmelaan 27, Utrecht.

Part I. THE HERBARIA OF THE WORLD, 6e éd., par P. K. HOLGREM et W. E. KEUKEN, *in* Regnum vegetabile vol. 92, 397 p., 1974, toilé. Fl. 65.00.

Part II (3). COLLECTORS' INDEX I-L, par M. N. CHAUDHRI, I. H. VEGTER et C. M. de WAL, *in* Regnum vegetabile vol. 86, xxii + 177 p. (pp. 297-473), broché, 1972. Fl. 32.50

La nouvelle édition, revisée et élargie, de la partie I. THE HERBARIA OF THE WORLD, fait suite à la cinquième édition par J. Lanjouw et F. A. Stafleu, parue en 1964 avec 251 pages

Plus de 1500 herbiers publics du monde sont maintenant répertoriés, par ordre alphabétique de lieu, avec le nom officiel, le nom et l'adresse de l'institution, le sigle de l'herbier, le nom, la nature et l'importance des collections

(continued on page 194)

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NOTES ON COELOMYCETES. I.
CERATOPYCNIS, CLYPEOPYCNIS, MACRODIPLODIOPSIS, MASTIGOSPORELLA, PARADISCULA AND SEPTOPATELLA

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ABSTRACT

The genera *Ceratopycnis* Höhnel, *Clypeopycnis* Petrak, *Macrodiplodiopsis* Petrak, *Mastigosporella* Höhnel, *Paradiscula* Petrak and *Septopatella* Petrak, each based on a single species, are redescribed and illustrated. Emended diagnoses are provided.

INTRODUCTION

A considerable number of generic names of coelomycetes based on single species exist in the literature. Many of these were described in the first quarter of this century by such authors as Franz von Höhnel and Franz Petrak. During recent studies on coelomycetes type collections of some of these genera have been examined. In most cases no illustrations of them exist and the published descriptions, although sometimes quite elaborate are by no means fully adequate by modern standards, particularly with regard to the structure of the conidium bearing cells and the details of conidium ontogeny. In this series of papers it is intended to redescribe the species on which some of these and other genera are based as well as provide incidental notes on, and new descriptions and illustrations of, a wide range of coelomycetes.

In this first paper six genera are treated. Brief generic descriptions of these taxa were provided by Morgan-Jones and Kendrick (1972) and Morgan-Jones et al. (1972a, 1972b, 1972c).

TAXONOMIC PART

Ceratopycnis Höhnel, Sitzungsber. Kais. Akad. Wein Math.-Naturwiss. Kl. Abt. 1. 124:86, 1915.

Pycnidia scattered or sub-gregarious, at first immersed, later becoming erumpent, black, glabrous, beaked, ostiolate, unilocular. Pycnidial wall pseudoparenchymatic. Conidiogenous cells phialidic, hyaline, smooth-walled, cylindrical to ampulliform, frequently proliferating percurrently. Conidia ellipsoid, thick-walled, septate, yellowish-brown, verruculose.

TYPE SPECIES: *C. clematidis* Hohnel.

Ceratopycnis clematidis Höhnel, Sitzungsber. Kais. Akad. Wiss. Wein, Math.-Naturwiss. Kl. Abt. 1. 124:86, 1915 (Figure 1).

Immersed mycelium abundant, extensive in woody tissue, composed of hyaline to pale brown, septate, branched, smooth-walled hyphae, 3-4.5µm wide. Pycnidia globose to subglobose, solitary, scattered or somewhat gregarious, at first immersed, later erumpent through the periderm and becoming almost superficial, black, glabrous, unilocular, with a well developed, tapering, erect neck, 130-250µm in diameter, neck up to 370µm long, 60-75µm wide at the base, 30-50µm wide at the apex. Pycnidial wall composed of an outer layer of thick-walled, somewhat sclerotioid, brown, more or less isodiametric, pseudoparenchymatous cells, and an inner layer of pale brown to subhyaline cells lining the venter, 20-26µm wide; cells in the neck area elongated and the inner cells giving rise to short, septate, pale brown periphyses, 12-25 X 2-3.5µm. Conidiophores short, micronematous to semi-macronematous, mononematous, subhyaline to hyaline, smooth, lining the pycnidium venter up to the base of the neck. Conidiogenous cells phialidic, integrated, cylindrical to ampulliform, hyaline,

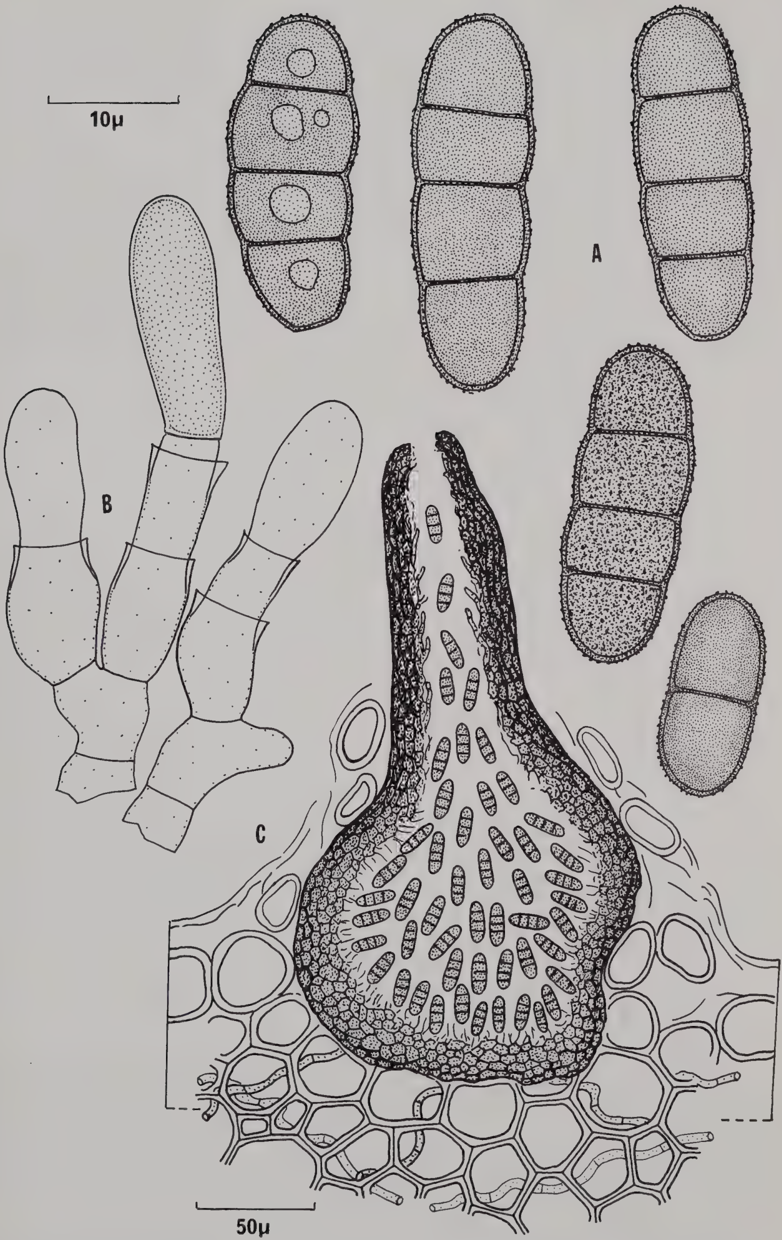

FIGURE 1. *Ceratopycnis clematidis*. A, Conidia; B, conidiophores; C, v.s. pycnidium.

smooth, of varying length, proliferating percurrently, sometimes to a distance equal in length to the original cell, initial phialides and proliferations flaring slightly distally, 6-11 X 4-5μm. Conidia cylindrical, or somewhat elliptical, obtuse at each end, 3-septate, rarely 1-septate, constricted very slightly at the septa, thick-walled, mid-brown, verruculose, 18-26 X 7-9μm.

On twigs of *Clematis vitalba*; Europe.

COLLECTION EXAMINED: On *C. vitalba*, Sonntagsberg, Lower Austria, XII 1914, P.P. Strasser, Type, FH.

Von Höhnel (1915) described the ostiole at the tip of the neck of *Ceratopycnis clematidis* as often having pale cilia, 60 X 1.5μm in size. Such structures have not been observed in this study. Many of the pycnidial necks in the material examined had broken off and, in order to preserve the type which consists of but few pycnidia, only one pycnidium still bearing a neck was used for microscopic examination. Von Höhnel also noted the presence of small, poorly developed pycnidia with paler conidia intermixed with the mature form.

Clypeopycnis Petrak, Ann. Mycol. 23:76, 1915.

Pycnidia scattered, immersed, subcuticular, ostiolate, glabrous, unilocular. Pycnidial wall thin, pseudoparenchymatic, extending above to form a thick, dark-brown to black clypeus. Conidiogenous cells phialidic, hyaline, smooth-walled, narrowly ampulliform. Conidia cylindrical, hyaline, 1-septate, smooth-walled.

TYPE SPECIES: *C. aeruginascens* Petrak.

Clypeopycnis aeruginascens Petrak, Ann. Mycol. 23:76, 1925 (Figure 2).

Immersed mycelium sparse, composed of branched, hyaline, smooth-walled hyphae, 1.5-3μm wide. Pycnidia globose to subglobose or somewhat flattened and elongate along the longitudinal axis of the host, solitary, scattered or densely gregarious, immersed, glabrous, unilocular, ostiolate and slightly papillate through a brown intraepidermal clypeus which covers the pycnidium above, 150-200μm in

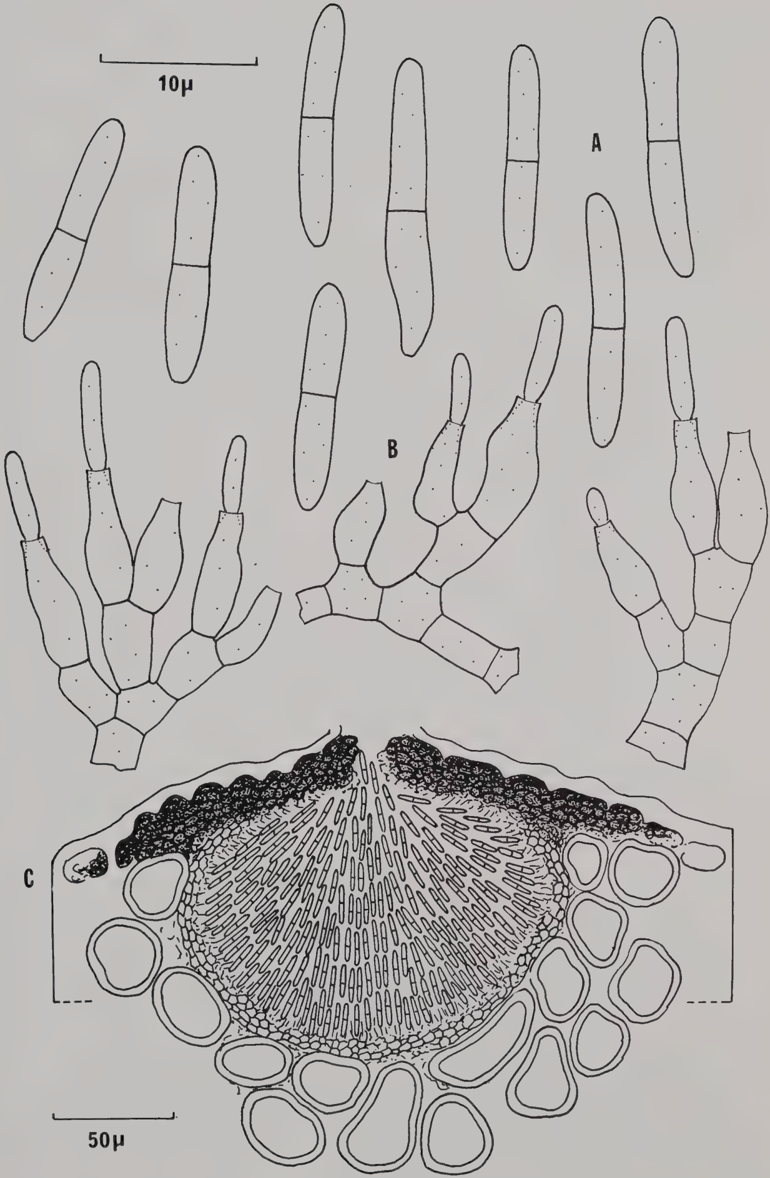

FIGURE 2. *Clypeopycnis aeruginascens*. A, Conidia; B, conidiophores; C, v.s. pycnidium.

diameter. Pycnidial wall narrow, composed of thin-walled, isodiametric, pseudoparenchymatous, subhyaline to hyaline cells, continuous with the overlying clypeus. Clypeus composed of brown, thick-walled, elongate cells, plectenchymatous, up to 280µm wide, 8-14µm thick. Conidiophores short, semimacronematous, mononematous, hyaline, septate, smooth, lining the entire pycnidium venter. Conidiogenous cells phialidic, integrated, terminal, obclavate to narrowly ampulliform, hyaline, smooth, 3-6 X 1.5-2µm. Conidia cylindrical, straight or very slightly curved, obtuse at each end, 1-septate, hyaline, smooth, 9-15 X 1-1.5µm.

On twigs of *Ribes missouriensis*; N. America.

COLLECTION EXAMINED: On twigs of *R. missouriensis*, Northville, N. Dakota, U.S.A., V 1924, J.F. Brenckle, F. Petrak - Mycotheca generalis 67, Type, FH.

Macrodiplodiopsis Petrak, Ann. Mycol. 20:343, 1922.

Pycnidia mostly gregarious in dense groups, frequently almost confluent, immersed in periderm, ostiolate, glabrous, unilocular, subglobose, flattened, dark brown to black. Pycnidial wall pseudoparenchymatic. Conidiogenous cells phialidic, hyaline, smooth-walled, cylindrical to narrowly ampulliform, frequently proliferating percurrently. Conidia ellipsoid to obovoid, obtuse at the apex, somewhat truncate at the base, yellowish brown, outer wall verruculose, enclosing three, or usually four, thick-walled endoconidial cells.

TYPE SPECIES: *M. desmazieri* (Mont.) Petrak.

Macrodiplodiopsis desmazieri (Mont.) Petrak, Ann. Mycol. 20:343, 1922 (Figure 3).

≡ *Hendersonia desmazieri* Montagne, Ann. Sci. Nat. Sér. 3, 12:310, 1849.

= *Stegonosporium platani* Preuss, Linnaea 26:723, 1853.

Immersed mycelium composed of pale brown, septate, branched, smooth-walled or sometimes roughened, 3-4µm wide hyphae. Pycnidia subglobose, distinctly flattened, gregarious, unilocular, ostiolate, with a short apical papilla which emerges

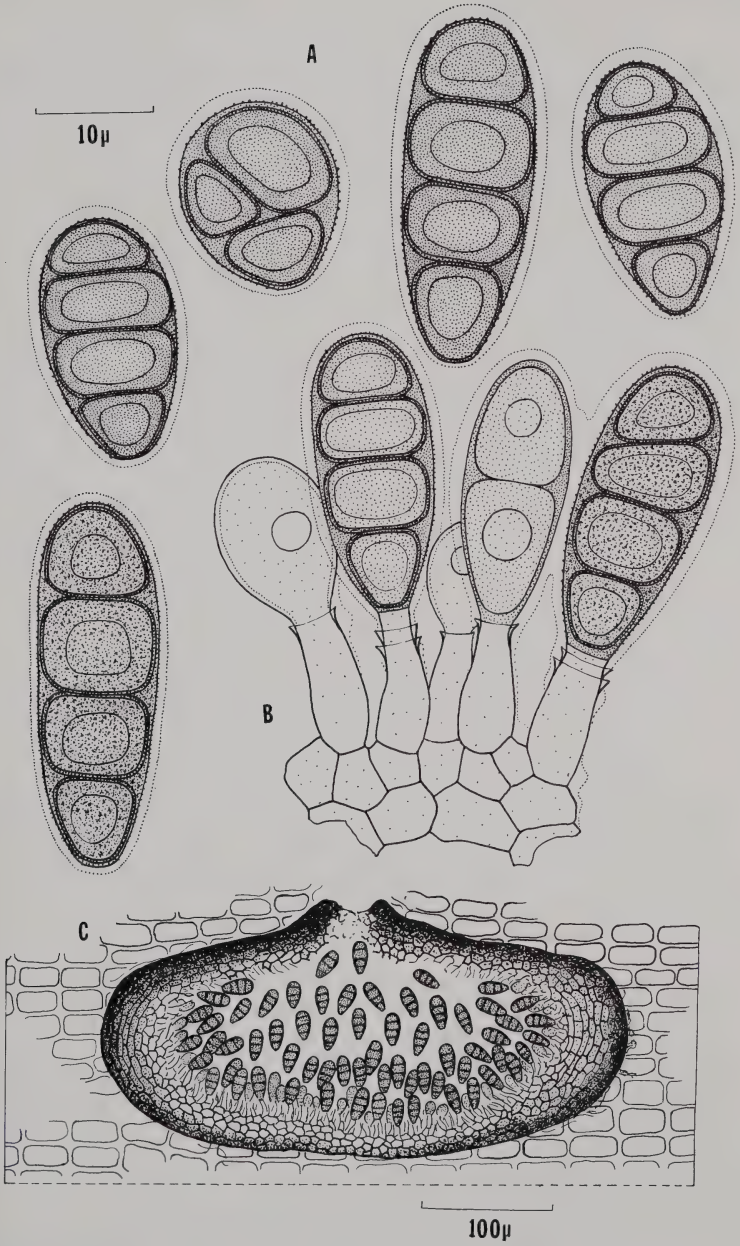
A
10μ
B
C
100μ

FIGURE 3. *Macrodiplodiopsis desmazieri*, A, Conidia; B, conidiophores; C, v.s. pycnidium.

through the periderm, 350-600µm in diameter, 250-300µm high. Pycnidial wall composed of two ill-defined layers; an outer layer of thick-walled, mid-brown, isodiametric, or, at the sides, elongate, pseudoparenchymatous cells, and an inner layer of thinner-walled, isodiametric, pale brown to subhyaline cells lining the pycnidium venter, 25-30µm wide at the base, 40-80µm wide above. Conidiogenous cells phialidic, cylindrical to ampulliform, hyaline, smooth, of varying length, proliferating percurrently, flaring slightly distally, 8-14 X 2-3µm. Conidia solitary, ellipsoid to obovoid, straight, obtuse at the apex, somewhat truncate at the base, yellowish-brown, covered with a gelatinous sheath, with an outer verruculose wall enclosing three, or usually four, thick-walled, compressed endoconidial cells, each containing a large guttule; 40-48 X 18-20µm.

On twigs of *Platanus* spp.; Europe and N. America.

COLLECTION EXAMINED: On *P. orientalis*, Parklangen, Mähr-Weisskirchen, Czechoslovakia, VII 1938, F. Petrak, Petrak - Mycotheca generalis 595, FH.

Preuss (1853) described his *Stegonosporium platani* from a collection on *Platanus* made at Hoyerswerda, Saxony, as follows "Gregarium; peritheciis cortici immersis, tectis, atris; basidiis filiformibus, albis; sporis subpyriformibus, fuscis; nucleo quater in una serie posito." Although the type collection has not been seen there can be no doubt that he had the same fungus as Montagne.

Petrak (1922) considered the possibility of classifying *M. desmazieri* in either *Macrodiplodia* Sacc., or in his *Neohendersonia* Petrak, proposed the previous year (Petrak 1921) to accommodate *N. pyriformis*, another fungus originally classified in *Hendersonia* Sacc. In deciding to erect a new genus for *M. desmazieri* he recognized certain morphological distinctions that serve to separate it from the other two genera, although he admitted their probable relationship as conidial states of *Massaria* de Notaris and related genera.

M. desmazieri differs from *Macrodiplodia* in possessing several-celled conidia with well developed cross walls, and from *Neohendersonia* in that the conidial cells are more or less equal in size and the whole conidium is enveloped by a mucilaginous sheath.

Sutton and Pollack (1974) have recently redescribed *Neohendersonia* and recognized the name *Stilbospora kicksii* Westendorp as being the earliest to be applied to the fungus on which the genus is based. They accepted the genus and provided the name *Neohendersonia kicksii* (West.) Sutton and Pollack for the type species. A thickened basal scar on the conidia was noted as a distinctive feature, this being rarely encountered in the pycnidial fungi. The conidiogenous cells were described as being annellidic but they have essentially the same structure as the proliferating phialides described above.

There is little difference between *Macrodiplodiopsis* and *Neohendersonia* and it may well be that the absence of a distinctly thickened basal scar and the possession of a conidial gelatinous sheath are insufficient reasons for maintaining them as separate genera. If they were considered congeneric *Neohendersonia* would have date priority. For the present a conservative attitude is adopted and *Macrodiplodiopsis* is maintained.

Macrodiplodiopsis desmazieri is considered to be the conidial state of *Massaria platani* Cesati.

Mastigosporella Höhnel, Sitzungsber. Kais. Akad. Wiss. Wien, Math.-Naturwiss. Kl. Abt. 1. 123:135, 1914.

Acervuli scattered or somewhat gregarious, pale yellowish brown, intra or subepidermal, rupturing the cuticle and epidermis irregularly, cup-shaped, stroma composed of isodiametric, thin-walled, very pale brown cells. Conidiogenous cells phialidic, cylindrical to ampulliform, hyaline, smooth-walled, occasionally proliferating percurrently. Conidia narrowly ellipsoid to fusiform, straight or very slightly curved, unicellular, guttulate, hyaline, smooth-walled, with one apical, simple appendage, truncate at the base with a minute marginal frill.

TYPE SPECIES: *M. hyalina* (Ell. and Everh.) Höhnel.

Mastigosporella hyalina (Ell. and Everh.) Höhnel, Sitzungsber. Kais. Akad. Wiss. Wien, Math.-Naturwiss. Kl. Abt. 1. 123:135, 1914 (Figure 4).

≡ *Harknessia hyalina* Ellis and Everhart, J. Mycol. 1:92, 1885.

Immersed mycelium composed of subhyaline to very pale brown, septate, branched, smooth-walled hyphae, 2-3μm wide. Acervuli abundant, scattered or somewhat gregarious, intra or subepidermal, hypophyllous, pulvinate when mature, pale yellowish-brown, rupturing the cuticle and epidermis irregularly, frequently giving a stellate appearance when viewed from above, 230-280μm in diameter. Stroma pseudoparenchymatous, immersed in the substratum or exposed where it extends upwards to form a wide, sometimes cup-shaped fructification, intra or subepidermal, composed of isodiametric, thin-walled, very pale brown cells, 10-16μm thick. Conidiophores short or somewhat elongate, micronematous to semimacronematous, made up of a column of short, horizontal cells, bearing conidiogenous cells terminally and laterally. Conidiogenous cells phialidic, cylindrical to ampulliform, hyaline, smooth, with a minute terminal collar; occasionally proliferating percurrently, 4-10 X 2.5-4μm. Conidia narrowly ellipsoid to fusiform, straight or very slightly curved, unicellular, relatively thick-walled when mature, guttulate, hyaline, smooth, with one apical, simple appendage which is delimited from the conidium by an indistinct, distal, transverse septum; truncate at the base with a marginal frill, the septum delimiting the conidium laid down above the level of the conidiogenous cell collar; 18-24 X 3.5-5μm, appendages 8-17 X 1μm.

On leaves of *Quercus coccinea*; N. America.

COLLECTION EXAMINED: On *Q. coccinea*, Newfield,

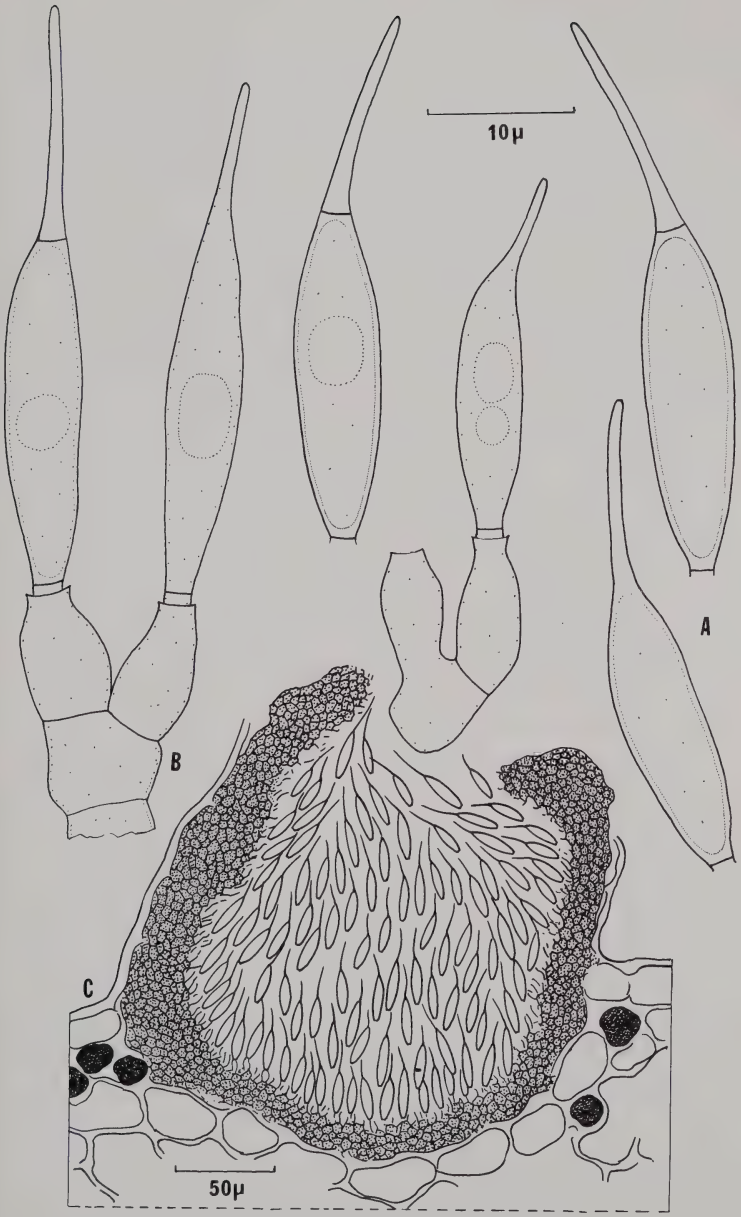

FIGURE 4. *Mastigosporella hyalina*. A, Conidia; B, conidiophores; C, v.s. acervulus.

New Jersey, U.S.A., 6 VI 1885, J.B. Ellis, Type, NY.

Ellis and Everhart (1885) noted that the general appearance of this taxon is very much like that of *Harknessia caudata* Ell. and Everh., but that it varies from *Harknessia* Cooke by its hyaline conidia. Von Höhnel (1914) concluded that, although *H. hyalina* has a similar structure to *Harknessia*, the possession of hyaline conidia bearing a long apical appendage justified its recognition as a separate entity. Sutton (1971) in his mongraphic treatment of *Harknessia* accepted von Höhnel's opinion. In addition to the colour of the conidia it should be noted that the pattern of conidiogenesis in the two genera is different. In *Harknessia* the conidia are holoblastic in origin, whereas in *Mastigosporella* they are enteroblastic.

Physalospora quercifolia Ell. and Everh. was described from the same leaves as *H. hyalina*, with the suggestion that it might be the "stylospore stage" of this ascomycete.

Paradiscula Petrak, Ann. Mycol. 39:307, 1941.

Acervuli scattered or occasionally gregarious in groups of a few, black, subepidermal, rupturing the epidermis at maturity, at first completely covered, later discoid, stroma composed of isodiametric, brown cells. Conidiogenous cells phialidic, ampulliform, hyaline, smooth-walled. Conidia oblong to somewhat ellipsoid, straight, obtuse at each end, unicellular, guttulate, hyaline, smooth-walled.

TYPE SPECIES: *P. spuria* (Vesterg.) Petrak.

Paradiscula spuria (Vesterg.) Petrak, Ann. Mycol. 39:308, 1941 (Figure 5).

≡ *Phoma spuria* Vestergren, Jahreskat. Wien Krypt. Tauschanst. 4, 1897.

Immersed mycelium composed of subhyaline to pale brown, septate, branched, smooth-walled hyphae, 2-3μm wide. Acervuli abundant, scattered or occasionally gregarious in groups of a few, rarely confluent, subepidermal, immersed at first, later becoming erumpent and rupturing the epidermis

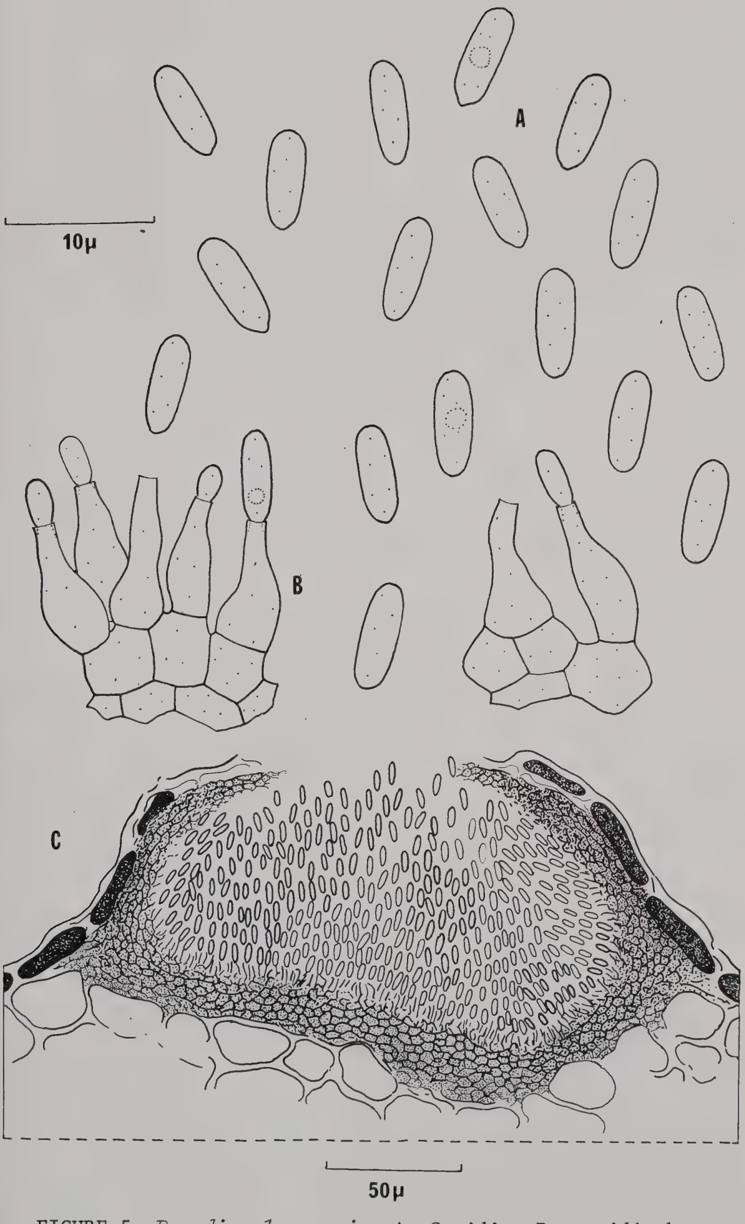

FIGURE 5. *Paradiscula spuria*. A, Conidia; B, conidiophores; C, v.s. acervulus.

irregularly; black, elliptical, elongate along the longitudinal axis of the host substrate, pulvinate when mature, 200-500µm in diameter. Stroma at first forming a flattened hollow ball, completely enclosing the conidiogenous cells, then opening by a slit to give the fructification a somewhat discoid appearance in section, pseudoparenchymatous, partly immersed, partly superficial when old, composed of isodiametric or somewhat elongate, pale to mid brown cells; 30-70µm thick. Conidiogenous cells phialidic, narrowly ampulliform to ampulliform, hyaline, smooth, 5-14 X 2-3.5µm. Conidia oblong to somewhat ellipsoid, short, straight, unicellular, guttulate, hyaline, smooth, obtuse at each end, 4-6 X 1.5-2.5µm.

On stalks of *Potentilla argentea*; Europe.

COLLECTION EXAMINED: On *P. argentea*, Svrcow, Mähr-Weisskirchen, Czechoslovakia, V 1936, F. Petrak, Petrak - Mycotheca generalis 195, FH.

Petrak (1941) at first considered reclassifying this species in *Plenodomus* Preuss as *P. spurius* (Vestergr.) Petrak. He also recognized a similarity between it, *Sporonema* Desm., and *Discula* Sacc. However he pointed out that it differs from these genera by the thick basal layer of the stroma and by the cover which opens in a slit.

Septopatella Petrak, Ann. Mycol. 23:128, 1925.

Acervuli widely scattered, superficial, pulvinate, dark reddish-brown to black, discoid, with a flat basal stroma composed of small, isodiametric, brown cells and a lateral excipulum composed of olive-brown hyphae. Conidiogenous cells phialidic, cylindrical, straight or slightly flexuous, hyaline, smooth. Conidia long-cylindrical, acicular, falcate, filiform, hyaline, septate, guttulate, smooth.

TYPE SPECIES: *S. septata* (Jaap) Petrak.

Septopatella septata (Jaap) Petrak, Ann. Mycol. 23: 128, 1925 (Figure 6).

≡ *Pseudocenangium septatum* Jaap, Ann. Mycol. 6:219, 1908.

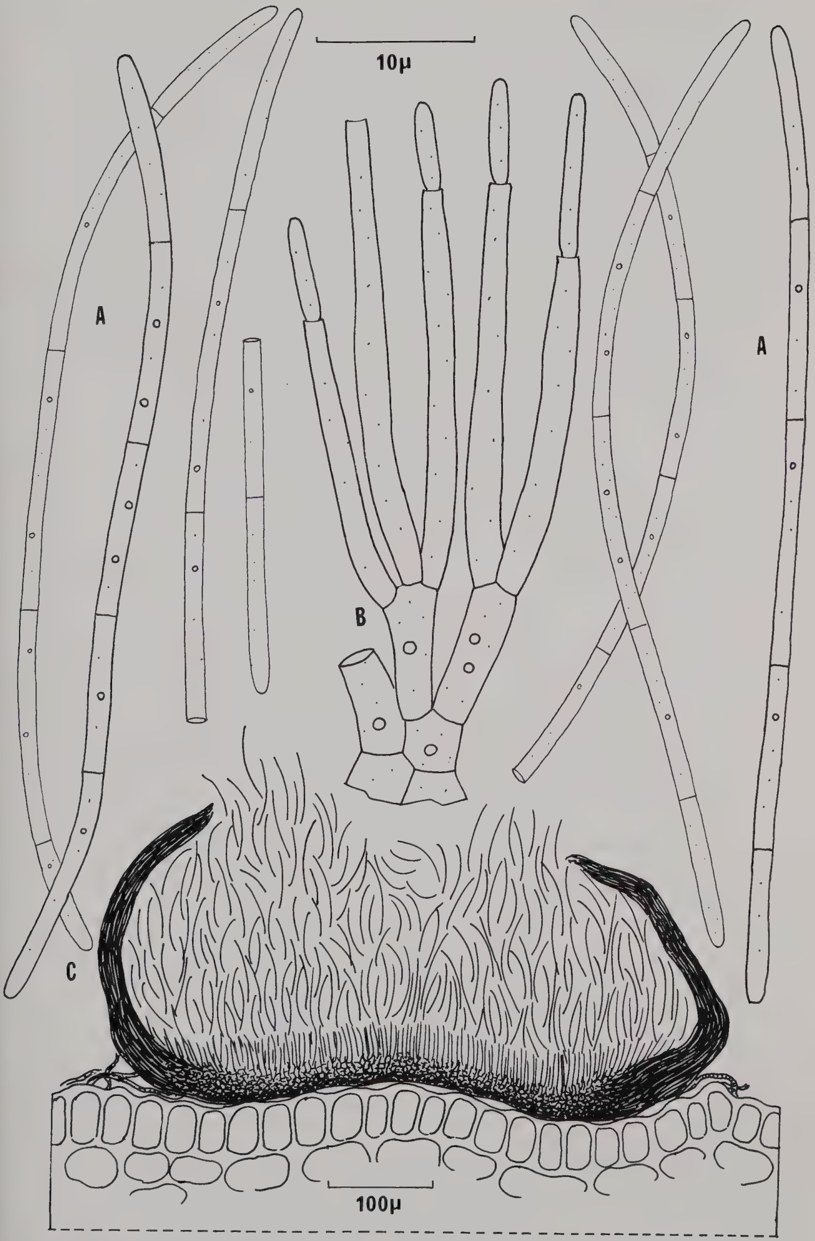
10μ
A
A
B
C
100μ

FIGURE 6. *Septopatella septata*. A, Conidia; B, conidiophores; C, v.s. acervulus.

Immersed mycelium composed of hyaline to subhyaline, septate, branched, smooth-walled hyphae, 2-2.5µm wide; superficial mycelium forming a network around the base of the side of the fructification, composed of olive-brown, septate, branched, smooth-walled hyphae, 2-3µm wide, slightly thicker walled than the immersed mycelium. Acervuli scattered or sometimes in groups of a few, superficial, pulvinate, dark reddish brown to black, discoid when mature, 500-900µm in diameter. Stroma at the base flat, pseudoparenchymatous, composed of more or less isodiametric, subhyaline to mid olive brown cells, 15-25µm wide, becoming up to 70µm wide and darker towards the edge, and composed of elongate, olive brown cells; extending laterally to form a covering layer of closely adpressed, parallel, mid olive brown hyphae. Conidiophores macronematous, mononematous, cylindrical, hyaline, smooth, branched. Conidiogenous cells phialidic, in verticils of two to four, long cylindrical, tapering slightly distally, straight or somewhat flexuous, hyaline, smooth, 9-28 X 2-3µm. Conidia long cylindrical, acicular, falcate, or sometimes almost straight, filiform, septate, guttulate, hyaline, smooth, obtuse at each end, 30-68 X 1.5-2µm.

On needles of *Pinus pumila*; Europe.

COLLECTION EXAMINED: On *P. pumila*, Hochgesenke, Hochschar., Czechoslovakia, 10 VIII 1924, F. Petrak, Petrak - Fungi Boh. et Mor. 1965, FH.

Petrak (1925) stated that *Pseudocenangium* Karsten, based on *P. pinastri* Karsten, should be restricted to forms with comparatively short, narrow, cylindrical, mostly straight conidia, arising by 'decay' of long hyphae. Morgan-Jones et al. (1972c) redescribed this genus and showed the conidia to be holoblastic-annellidic. The genus differs from *Septopatella*, whose conidiogenous cells are enteroblastic-phialidic, on this account. In addition the texture of the lateral excipulum in the two genera is quite different. In *Pseudocenangium* the tissue is less distinctly hyphal.

ACKNOWLEDGMENTS

I am grateful to Dr. I.M. Lamb for allowing me free access to the collections while on a visit to the Farlow Herbarium, Harvard University, and to Dr. C.T. Rogerson, New York, for making available for study the collection in his keeping.

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NOTICES *(continued from page 142)*

completely rearranged and indexed. Specimens are now easily locatable and logically filed.

The Special Collections — Several large herbaria are kept as separate units; these are the herbaria of M.A. Curtis, N.T. Patouillard, E.A. Burt, E. Bartholomew, F. von Höhnel, and J.B. Ellis (Herbarium Mycologicum), as well as the smaller C.J. Sprague and Thomas Taylor herbaria. Of these, the Burt Herbarium (30,000 specimens) and Patouillard Herbarium (50,000 specimens) are currently receiving attention. The greatly neglected Burt Herbarium, purchased in 1931, has been rearranged, remounted, and reconditioned. Bibliographic work is now nearing completion on the publications of N. Patouillard and soon work will begin on marking the previously unindicated type material in this collection.

The voucher specimens of the fungi illustrated by Joseph Bridgham and Louis C.C. Krieger, also treated as separate collections, have been rearranged as have been their magnificent color illustrations. There are about 600 illustrations of which 103 were published in the *Icones Farlowianae*. Voucher specimens are available for most specimens illustrated.

The Exsiccati — The undistributed bound exsiccati, which were previously indexed, are also undergoing reconditioning and repair. Bindings are being mended or replaced, specimens are being repacketed, and the index to the exsiccati is being checked. There are about 143 exsiccati sets containing well over 100,000 fungus specimens.

With continued work along these lines and with the cooperation of the users of these collections the large backlog of specimens will be sorted and inserted, inventories of holdings will be completed, and special collections organized and indexed. The result will be a more accessible and useable resource.

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AQUATIC FUNGI OF SCANDINAVIA: AN UNUSUAL WATERMOLD FROM NORWAY

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SUMMARY

A watermold producing ornamented oögonia and ovoid or oval sporangia renewed internally or sympodially is described. The sporangia release laterally biflagellate planonts that become subapically biflagellate without prior encystment. Generic affinities are uncertain, but the fungus is assigned provisionally to *Saprolegnia* (without a specific epithet). The sporangia may be parasitized by a chytrid tentatively identified as *Phlyctochytrium zygnematis*.

Samples of sediment, water, insect exuviae, and decaying *Sphagnum* spp. from acid lakes in southern Norway have yielded a diverse flora of zoösporic fungi. A watermold from two such lakes northeast of Oslo is described.

The fungus, tentatively assigned to *Saprolegnia*, was first found on exuviae of a chironomid collected among emergent vegetation in Bakketjernet. Subsequently, the watermold grew on snakeskin bait in water and debris expressed from shoreline populations of *Sphagnum* spp. The fungus would not grow on Emerson's YpSs agar (1/4, 1/2, full strength), Barksdale's (1962) medium, Seymour's (1970) chemically defined medium, or on the media formulated by Booth & Miller (1961) and Fuller, *et al*. (1964). The latter two media were prepared in distilled and in filtered lake water rather than seawater. Hempseed, the usual bait for saprolegniaceous fungi, failed to support growth as well.

Unifungal cultures were established by using strips of sterile snakeskin as the substratum. A sporangium and subtending hypha (along with a bit of the original bait) was transferred to 1 ml of sterile lake water in the bottom of a plastic Petri plate. Squares (2 mm) of autoclaved (121° C, 15 min) snakeskin were added, and the cultures incubated for 52 hours. Infested baits were subsequently transferred to sterile Petri plates containing 40 ml of filtered, autoclaved pond water, and the cultures baited with 2-3 strips (1 cm long) of sterile snakeskin. Within 3-7 days mature thalli developed and the fungus was then examined and characterized. The organism would not grow in water (from any of several sources) or on any medium in which 0.01% potassium tellurite (Willoughby, 1958) was used as a bacterial suppressant.

OBSERVATIONS

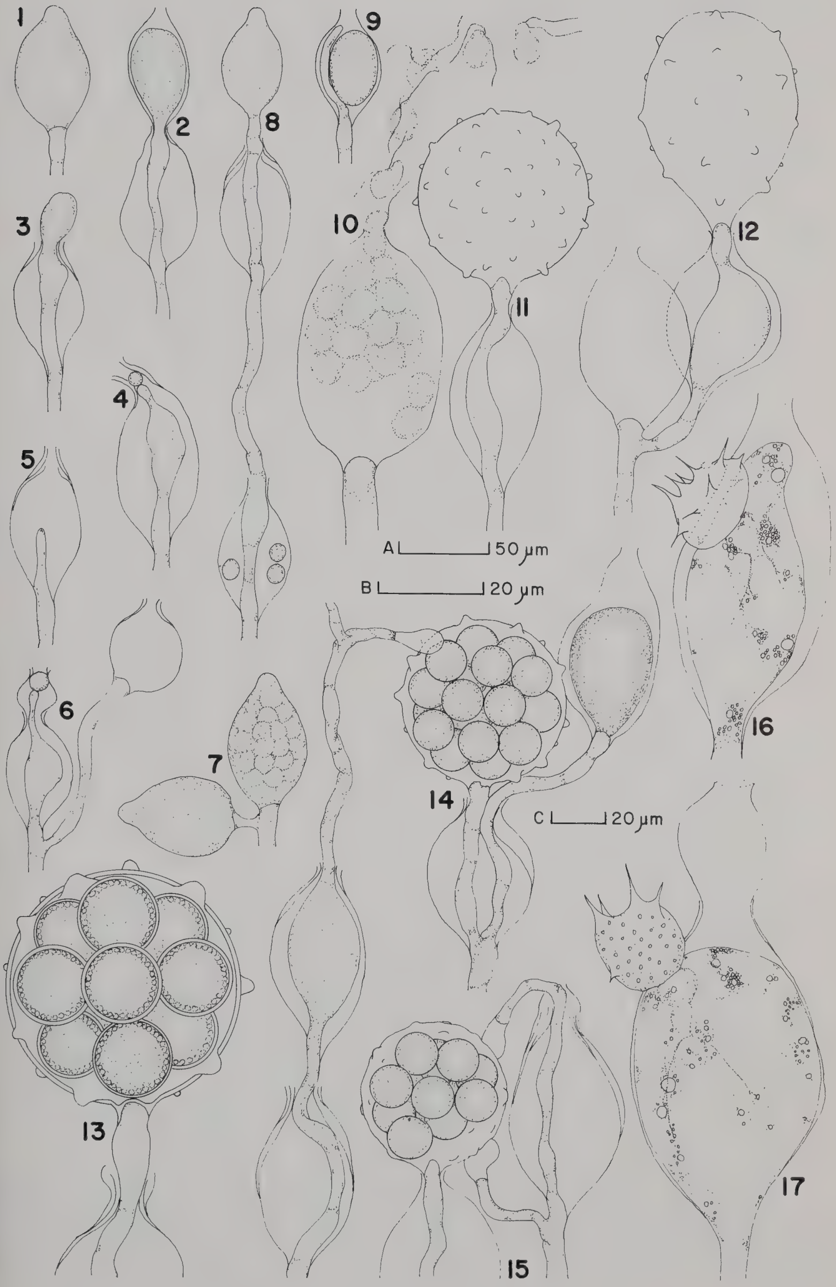
The primary sporangia of the *Saprolegnia* were oval, ovoid (Fig. 1) or obpyriform, and had a conspicuous apical discharge papilla (Figs. 1, 7). Secondary sporangia were usually similarly shaped, but could be nearly spherical or irregularly oval (Figs. 6, 12) as well. While the sporangia were predominantly terminal on the main hyphae (Figs. 2, 8), ones on short lateral branches (Figs. 6, 7) were also formed.

Planonts were cleaved endogenously (Fig. 7), and escaped singly through an apical pore. Under the culture conditions employed, sporangia required 1-2 hours or more for complete evacuation. This time could not be shortened substantially even if sporangia were flooded occasionally with fresh pond or distilled water during discharge. Until released, the planonts maintained a slight rocking and circulating motion.

At discharge, the planonts emerged sluggishly through the confining orifice, and slowly swam away (with a tumbling, twisting action) as laterally biflagellate cells. Subsequently, they assumed a nearly spherical shape, then elongated slightly, and became subapically biflagellate (Fig. 10). After varying periods of motility, the planonts encysted and, when settled on the substratum, produced new hyphae directly. Repeated encystment and emergence (of motile cells) -- as is common in some watermolds -- was not observed.

What appeared to be gemmae (Fig. 14) were present in some cultures. These were densely cytoplasmic cells that evidently developed simply as terminal enlargements of hyphae proliferating through emptied sporangia. In some discharged sporangia there were large oval cells (Fig. 9) that were not attached to the sporangium wall or to the proliferating hypha. These bodies appeared to be remnants of undifferentiated sporangial protoplast rather than gemmae.

FIGS. 1-15. *Saprolegnia* sp. 12241. 1. Immature primary sporangium. 2-5. Internal proliferation. 6, 7. Sympodial branching (for sporangial renewal). 8. Repeated proliferation and hyphal elongation. 9. Growth of hypha around a sporangial protoplast. 10. Planont discharge, and sequential changes in flagellum orientation. 11, 12. Surface views of oögonia. 13. Mature oögonium showing papillae (protrusions through the wall "pits") and centric oöspores. 14. Spherical oögonium and its attendant diclinous antheridial branch. Sporangium to right of oögonium contains a gemma. 15. Oögonium and attendant diclinous antheridia originating from an internal and a sympodial hyphal branch. FIGS. 16, 17. *Phlyctochytrium zygnematis*. 16. A discharged thallus on a secondary sporangium of *Saprolegnia* sp. 12241. 17. An immature thallus. Figures 1-9, scale A; figs. 10, 13, 16, 17, scale B; others, scale C.


A 50 μm
B 20 μm
C 20 μm

Oögonia (Figs. 11-15) were sparse in all cultures. Immature ones were smooth walled, but as oöspore cleavage proceeded, the wall became slightly wavy (Fig. 15) or sparsely or densely ornamented with papillae (Fig. 11). These were thin-walled, and appeared to be membranous protrusions through pits (Fig. 13). The papillae did not become thick walled as the oögonium matured, nor did they disappear as would be expected if they were merely expressions of changing turgor within the oögonium. In the specimens at hand (including those on infested chironomid exuviae) the oögonia terminated only those hyphae proliferating through discharged sporangia.

Antheridial branches, like the oögonia, were few. The diclinous antheridial filaments originated sympodially (Fig. 15) or internally through an empty sporangium (Fig. 14). Antheridial cells were simple, terminal, and appressed apically or laterally to the oögonial wall (Fig. 15). The mature oöspores were centric (Fig. 13).

Some immature sporangia in the original gross cultures (Herb. No. 12241) were parasitized by an ornamented *Phlyctochytrium* (Figs. 16, 17) that developed (though sparsely) along with the host in several unifungal cultures. The sporangia were small (9-15 µm in diameter by 7-12 µm high, exclusive of ornamentations), epibiotic, and were subtended by an apophysate, endobiotic rhizoidal system. The posteriorly uniflagellate planonts (2-3 µm in diameter) emerged through a subapical orifice (Fig. 16), clustered momentarily in a loose mass outside the opening, then swam away. Stages in inoculation and penetration were not observed.

The wall ornamentation pattern of this *Phlyctochytrium* was varied, but an apical collarette of 4 (rarely 3) slender, acute, nonconverging spines appeared on all thalli observed. In some plants, there were 1-2 rows of lateral spines around the outer periphery of the sporangium (Fig. 16), but in others, such spines were few and scattered (Fig. 17). Less than 18% of the ornamentations on all sporangia observed were bipartite.

This *Phlyctochytrium* also grew on the snakeskin substratum supporting the *Saprolegnia*, and developed as well on pine pollen (Herb. No. 12222) seeded in water expressed from *Sphagnum* sp. In the cultures on snakeskin, the infected watermold was accompanied by two other chytrids. One produced large thalli with dense enations (often bifurcate) that fused basally to form a partial reticulum on the sporangium surface. The second formed sporangia bearing simple and bifurcate lateral enations, in rows, but lacking an apical collarette of ornamentations.

TAXONOMY

The release, without prior encystment, of laterally biflagellate planonts from primary sporangia is not by itself unique among the aquatic fungi, but this characteristic coupled with an obviously saprolegniaceous thallus emerges as a significant taxonomic problem. The flagellum insertion pattern recalls pythiaceous fungi or the Thraustochytriaceae. Oöspore type (among other features) is not that of the former, and the hyphal development precludes assignment to the latter family. An affinity of the Norwegian fungus with the Saprolegniaceae seems more logically indicated, though this is by no means a fully satisfactory disposition.

Sporangium shape in this watermold resembles that common to species of *Pythiopsis* deBary (Coker, 1923). In *P. humphreyana* Coker (1914) sporangia are renewed sympodially as are those of this fungus from Norway. *Pythiopsis cymosa* deBary (1888) also has sympodial branching, but its frequency is not pronounced. Oögonium structure and the pattern of flagellum insertion in emerging planonts bars assignment to *Pythiopsis*. In members of this genus the planonts released from primary sporangia are apically biflagellate.

Species of *Protoachlya* (Coker, 1923) exhibit some variations in patterns of planont emergence and flagellation. Coker (1923: p. 92) reports several variants in *P. paradoxa*, noting in one instance that the released planonts were elongate, but bent "...backward at the ends and then fuse(d) into a pear-shaped spore..." With this exception, however, the planonts in *P. paradoxa* are initially apically biflagellate if saprolegnoid discharge is effected or encyst immediately outside the orifice if emergence is achlyoid. While the sporangia of *P. paradoxa* (Coker, 1923) are internally and sympodially renewed, they are cylindrical. Sporangium shape and absence of achlyoid discharge prevent identification of my specimens as either *P. hypogyna* (Shanor & Conover, 1942) or *P. polysporus* (Apinis, 1930). Moreover, in these Protoachlyas the planonts are anteriorly biflagellate, and in the latter, dictyoid discharge may occur. In *P. hypogyna* some oögonia are produced terminally on hyphae growing through old sporangia; the watermold from Norway has a similar pattern although this is more frequently expressed than in the *Pythiopsis*.

The affinities of the Norwegian plants are more with *Saprolegnia* than with any other known genus in the family. Thallus habit, oögonium and oöspore structure, as well as sporangium renewal patterns, readily admit the fungus to *Saprolegnia*. It should be noted also that even some primary planonts of recognized species in this genus swim with subapically attached flagella. None produces laterally biflagellate primary planonts, and yet it is on the basis of release pattern and flagellation insertion that most genera of Saprolegniaceae are recognized. Until such time as specimens can be grown as single spore isolates in pure culture and studied extensively under a variety of conditions, assignment to a new genus would be of dubious merit. The unusual characteristic of laterally biflagellate primary planonts may not persist in other culture conditions.

The watermold from acid lakes does not resemble closely any of the recognized species of *Saprolegnia* (Seymour, 1970). Its ornamented oögonia suggest an alliance with *S. asterophora* deBary, but the characteristics of wall pitting and antheridial origin (among other features) are quite different. Were the oögonia not ornamented, identification with *S. ferax* (Gruith.) Thuret or *S. diclina* Humphrey might be attempted since these two species, broadly conceived, are highly variable. Species identification, too, must await successful unisporal culturing of the fungus.

A formal description of *Saprolegnia* sp. 12241 follows.

Primary sporangia oval, ovoid, obpyriform, or broadly fusiform, occasionally subspherical; apex a broad, nearly truncate exit papilla; 44-81 µm long by 20-51 µm in diameter. Secondary sporangia oval, ovoid, obpyriform, or broadly fusiform, and often delimited in shape by the confines of previously produced ones; apical portion occasionally protruding beyond the primary sporangia, and then constricted, expanded or bent, and often irregular; renewal by internal proliferation or, infrequently, by sympodial branching; apical pore often enlarging as successive sporangia are produced internally. Planonts endogenously formed; emerging slowly and singly through the apical orifice as laterally biflagellate cells, swimming sluggishly, and by slight amoeboid motion becoming subapically (anteriorly) biflagellate; encysting before germinating to form new hyphae; occasionally encysting in a sporangium. Gemmae very sparse; pyriform; confined to discharged sporangia; germination not observed. Oögonia sparse; spherical or pyriform; at first smooth-walled, but becoming papillate or undulate as maturation proceeds; single; pitted; produced terminally on hyphae proliferating through discharged sporangia; spherical ones (43-)55-72(-107) µm in diameter, including ornamentations, pyriform ones (38-)49-77(-121) µm long by (30-)41-55(-66) µm in diameter. Antheridial branches sparse; slender, unbranched or sparingly branched; diclinous, originating as hyphae proliferating internally through sporangia or as sympodial branches; antheridial cells terminal, clavate, simple, attached apically or laterally to the oögonial wall; fertilization tubes not observed. Oöspores centric; (3-)12-24(-64) in number; (14-)16(-19) µm in diameter; germination not observed.

On exuviae (chironomid): Bakketjernet, 6 August 1974 (Herb. No. 12241); on snakeskin bait: water expressed from *Sphagnum* sp., Bakketjernet, 6 August 1974 (Herb. No. 12247), in water and sediment, edge of Gravtjernet, 7 August 1974 (Herb. No. 12255), and in soil, edge of Bakketjernet, 17 August 1974 (Herb. No. 12380).

The fungus (Figs. 16, 17) parasitizing the sporangia of *Saprolegnia* sp. 12241 is accommodated in *Phlyctochytrium* Schroeter (*sensu strictu*). Assigning a proper specific name to this chytrid is troublesome.

Among the ornamented species of *Phlyctochytrium* (Sparrow, 1960) are several with bipartite teeth, or with simple spines in whorls. The presence of a terminal set of spines in the Norwegian specimens recalls *P. planicorne* Atkinson (1909), but in that species (Johnson, 1973; Umphlett & Holland, 1960), the apical processes are convergent and there are no lateral enations. Some sporangia of *P. aureliae* Ajello (1942) from Iceland (Johnson, 1973) have sparse, scattered ornamentations, and this species is evidently notorious for its variability in this regard. However, all thalli of Ajello's species that I have collected generally produce bipartite enations. Although *P. mucronatum* Canter (1949) forms undivided teeth (as well as bipartite ones), its sporangia also possess a prominent apical spine. None of my specimens on the watermold has such a sporangial configuration.

Rosen's (1887: fig. 23) account of *Chytridium* (= *Phlyctochytrium) zygnematis* characterizes this species as having a terminal collarette of enations, and some lateral ornamentations as well. This is precisely the configuration of the epibiotic sporangia on the watermold. In Rosen's species, the wall ornamentations are figured as bipartite, yet such structures are not common in my material. Other characteristics of the Norwegian plants agree with those of *P. zygnematis* save for substratum. In my experience with phlyctidiaceous fungi (Johnson, 1973), substratum type has not proven to be a dependable taxonomic criterion.

Miller's (1968) account of ornamentation variation in a chytrid designated simply as "Dentate" bears prominently on identification in the dentigerate group of *Phlyctochytrium*. He shows (Miller 1958: figs. 17-20) sporangia with ornamentation patterns indistinguishable from those of my plants, yet the variations he illustrates developed in larger populations of ornamented forms identifiable both with *P. aureliae* and *P. mucronatum*.

This Norwegian chytrid digresses from the strictest interpretation of *Phlyctochytrium zygnematis*. The weight of evidence, however, particularly from general configuration of the sporangia, favors provisional identification of my specimens as Rosen's species. Certainly there exists insufficient grounds on which to propose a new taxon. The several ornamented forms accompanying on the same bait as this one on the watermold must be isolated, cultured, and examined thoroughly to determine if they are variants of one species or are a complex of one or more taxa with rather consistent patterns of ornamentation. Perhaps a critical sorting within the populations at hand will provide clues to the true identity of this parasitic chytrid.

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BOOK REVIEWS *(continued from page 166)*

le nom et la spécialité du personnel scientifique, les publications, et les possibilités de prêt et d'échange.

Le troisième fascicule de la seconde partie, COLLECTORS' INDEX I-L, fait suite aux fascicules A-D (1954, 174 p.) et E-H (1957, 121 p.). Cette index donne les noms de récolteurs botanistes du monde entier, les aires de récoltes, les groupes végétaux récoltés, l'importance des collections et les herbiers qui les préservent. Le présent fascicule répertorie plus de 330 noms de récolteurs mycologues et lichénologues.

L'INDEX HERBARIORUM est un de ces ouvrages dont le taxonomiste ne peut se passer.

LES CHAMPIGNONS, by Patrick JOLY, 256 p., 50 figs., with 112 color photographs by P. JOLY and H. SCHREMPP, 13 × 19 cm., bound, *in* Couleurs de la Nature, edited by Hatier s.a., 8 Rue d'Assas, 75278 Paris, 1972. FF 26.00.

This beautifully illustrated book is meant for beginners in mycology. It enlarges in a nice way the collection of small pocket manuals for field work. The coloured illustrations of the mushrooms described surpass in quality those of most field manuals.

The authors not only respected perfectly the relation of the species to their environment but they also managed to capture with accuracy the correct color tinges and the most typical characters.

Of the 110 species shown, 81 have a half-page illustration, the others a full or a double page. The half-page description given to each species includes the Latin name (without author's name), the French vernacular name, the group to which the species belongs, and a description of the species by field characters only. There are also useful comments about edibility and how to avoid confusion with related species.

The color illustrations are not grouped, perhaps unfortunately, but distributed in 120 pages of text. Indeed, the book is not a flora, but is meant as an introduction to the world of fungi, their groups, reproduction and ecology. The author's aim is to stimulate curiosity and to permit anyone to initiate himself in the knowledge of fungi.

CHECK LIST OF EUROPEAN POLYPORES, by M. A. DONK, Koninklijke Nederlandse Akademie van Wetenschappen, Afd. Natuurkunde, Verhandelingen *2*, 62, 469 pp., 1974, North Holland Publishing Co., P.O. Box 3489, Amsterdam, Fl. 110.—

Cette publication posthume de M.A. Donk est une compilation commentée de tout ce qui a été publié sur les polypores européens. L'auteur a voulu présenter la documentation qu'il a analysée dans une arrangement taxonomique conservatoire et aussi cohérent que possible, sur la seule base de taxa véri-

(continued on page 204)

MYCOTAXON

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NEW SPECIES OF RAVENELIA (UREDINALES)[1]

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SUMMARY

New species of *Ravenelia*, on the Mimosoideae of Continental North America, are described: *R. aurea* on *Acacia*, *R. hermosa* on *Leucaena*, *R. bajacalensis* on *Lysiloma*, *R. verrucata* on *Mimosa*, and *R. alamosensis*, *R. multispinosa*, *R. striatispora* on *Pithecellobium* (Mexico); *R. linda* on *Calliandra* (Honduras); *R. floridana* on *Pithecellobium* (U.S.A.).

This paper presents diagnoses and illustrations of nine new species of *Ravenelia*. All parasitize plants of the subfamily Mimosoideae of the Leguminosae in south temperate to tropical Continental North America. Six of the species are from the western side of Mexico, where the population and diversity of woody legumes are great. Collecting in this area has been mostly that of the senior author.

Ravenelia aurea sp. nov. (Fig. 1)

Spermogoniis amphigenis, conicis, subcuticularibus, in maculis minutis incrassatis dense aggregatis. Aeciis amphigenis, subepidermalibus, uredinoidibus, spermogoniis circumcirca, brunneis, paraphysibus numerosis, capitatis,

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[1] University of Arizona, Agricultural Experiment Station Journal Article No. 2434.

usque ad 22 µm diametro, ad apicem castaneo-brunneis basim versus hyalinis, membrana plus minusve uniformiter 3.5-5 µm crassa; sporis (22-)25-32(-35) x (11-)13-17(-18) µm, plerumque ellipsoideis vel anguste obovoideis, membrana 1.5-2 µm vel ad apicem leniter incrassata, ad apicem aureo-brunnea deorsum pallidiore, echinulata, poris germinationis 8, bizonatis. Urediniis aeciis conformibus (vel nullis?). Capitulis teliosporarum in aeciis (55-)60-70(-75) µm diametro, ex cellulis 4 vel 5 in omni directione compositis aureo-brunneis, facile secedens, levis, cellulis centralis (14-)18-22(-24) µm latis, cystidiis eodem numero quo cellulis marginalibus, adpressis vel semipendulis.

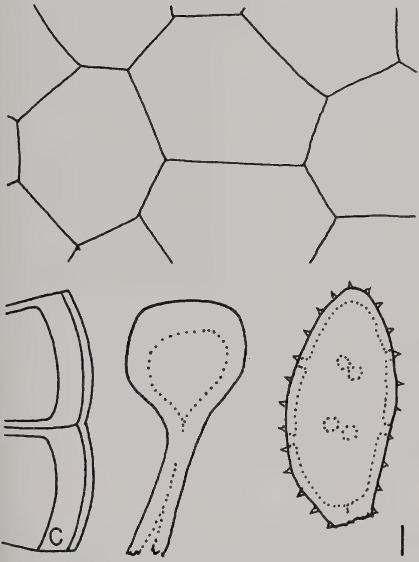
Holotype: on *Acacia pringlei* Rose, Mex hgw 190, km 786 w of Tehuantepec, Oaxaca, Mexico, 23 Feb. 1963, Barr No. 63-51 ex ARIZ 171780 (PUR 63746). Not otherwise known.

There are three other North American species on *Acacia* that have smooth teliospore heads, urediniospores with bizonate pores and paraphyses: *R. spegazziniana* Lindq., *R. thornberiana* Long and *R. versatilis* Diet. These have subcuticular uredinia and paraphyses with thinner walls. The golden teliospores, which separate easily, further distinquish *R. aurea.*

R. linda sp. nov. (Fig. 3)

Spermogoniis et aeciis ignotis. Urediniis amphigenis, sparsis, subcuticularibus, tarde dehiscentibus, brunneis, paraphysibus nullis; sporis (26-)30-36(-40) x (15-)17-20(-24) µm, ellipsoideis vel anguste obovoideis, membrana uniformiter 1-1.5 µm crassa vel ad apicem usque ad 2.5 µm crassa, pallide cinnamomeo-brunnea, echinulata, poris germinationis 4 vel 5, aequatorialibus. Teliis urediniis conformibus sed atro-brunneis; capitulis teliosporarum 55-70(-80) µm diametro, plerumque ex cellulis 4 in omni directione, pro parte maxima ex cellulis 4 centralis et 6 peripheralis compositis, castaneo-brunneis, quaque cellula (6-)10-20 spinae vel tuberculae ornatae, cellulis centralis

Figures 1-4. Species of *Ravenelia:* central cells of the teliospore head (top); margin of spore head (left); urediniospore and a paraphysis, when produced (right). 1. *R. aurea* on *Acacia.* 2. *R. hermosa* on *Leucaena.* 3. *R. linda* on *Calliandra.* 4. *R. floridana* on *Pithecellobium.* (All from types and to the same scale.)



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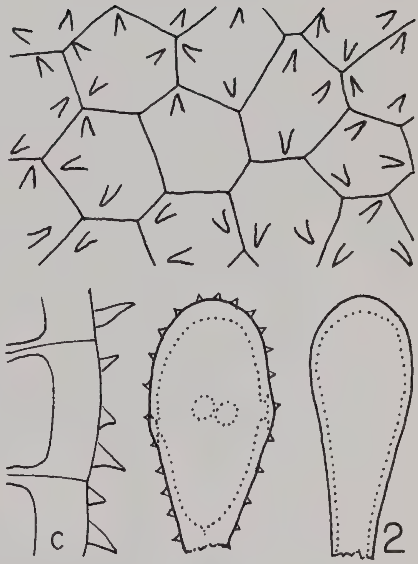

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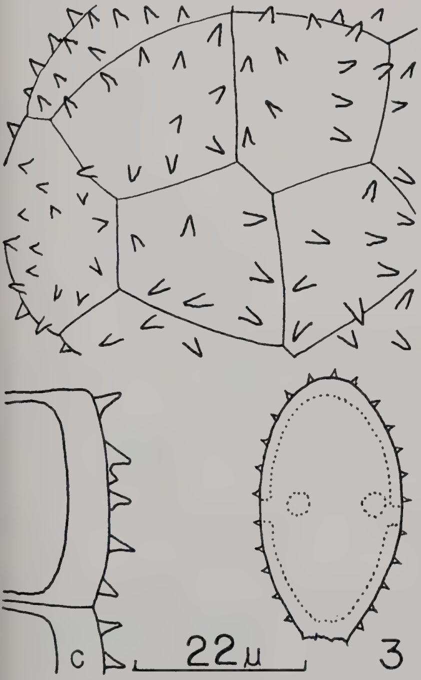

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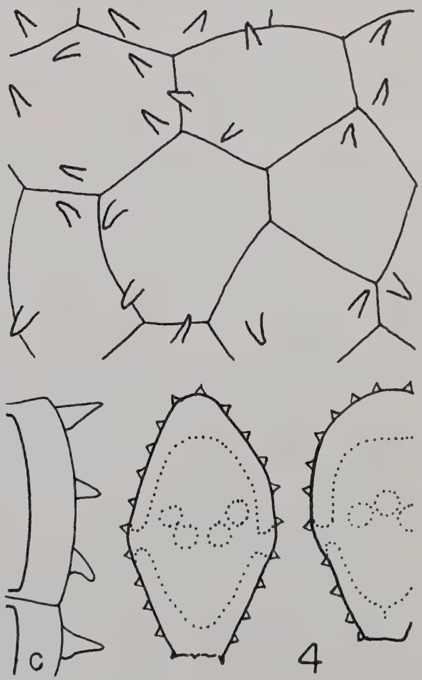

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(16-)19-24(-28) µm latis, cystidiis eodem numero quo cellulis marginalibus, globosis, plus minusve pendulis.

Holotype: on *Calliandra tapirorum* Standl., 5 km s of Ojo de Aqua, Region of Quebrada de dantas, Dept. El Paraiso, Honduras, 11 Dec. 1946, Standley, Williams and Molina No. 1254 (PUR 51702). Not otherwise known.

Eight species have spinose teliospore heads, urediniospores with equatorial pores and no paraphyses. Four have subcuticular sori (*R. linda, R. alamosensis, R. havanensis* Arth., *R. siderocarpi* Long) and four have subepidermal sori (*R. distans* Arth. & Holw., *R. floridana, R. multispinosa, R. pithecolobii* Arth.). Only *R. distans* and *R. linda* occur on *Calliandra. R. distans* has urediniospores mostly 22-26 µm long and apiculately thickened apically. *R. havanensis* has apically thickened urediniospores as does, but less conspicuously, *R. siderocarpi. R. linda* has about twice as many spines per teliospore as do the others of the group.

Ravenelia hermosa sp. nov (Fig. 2)

Spermogoniis subcuticularibus. Aeciis subepidermalibus, uredinoidibus, paraphyses peripherales clavatis, paucis; sporis (25-)28-35(-38) x 15-18(-20) µm, plerumque ellipsoideis vel obovoideis, membrana ad laterum 1.5-2 µm crassa, ad apicem 3-5 µm crassa, pallide castaneo-brunnea, echinulata, poris germinationis (3)4 vel 5, aequatorialibus. Urediniis amphigenis, subepidermalibus, paraphysibus brunneis numerosis; sporis aeciosporis conformibus. Teliis plerumque hypophyllis, subepidermalibus, atro-brunneis, paraphysibus nullis; capitulis teliosporarum 70-105 µm diametro, ex cellulis (5)6 vel 7(8) in omni directione compositis, castaneo-brunneis, quaque cellula (0-)2-4(-5) spinae ornatae, spinae 3-4.5 µm longae, ad apicem anguste rotundatae, cellulis centralis (10-)12-17(-20) µm latis, cystidiis eodem numero quo cellulis marginalibus, adpressis.

Holotype: on *Leucaena palmeri* Britt. & Rose, along stream, Mt. Alamos, Alamos, Sonora, Mexico, 14 Oct. 1970, Cummins No. 70-142 (PUR 63574).

Three other species (*R. expansa* Diet. & Holw., *R. leucaenae* Long and *R. verrucosa* Cooke & Ellis) occur on *Leucaena* in the area. *R. leucaenae* has urediniospores 38-50 µm long with subequatorial pores; the other two have spores in the range of 15-20 µm long and scattered pores.

All have paraphyses.

Ravenelia bajacalensis sp. nov. (Fig. 5)

Spermogoniis et aeciis ignotis. Urediniis subcuticularibus, pleumque hypophyllis nervus medius consociatis, flavo-brunneis, paraphysibus nullis; sporis (15-)16-19(-21) x (11-)13-16(-17) µm, oblongo-ellipsoideis, late ellipsideis vel late obovoideis, membrana (1.5-)2(-2.5) µm crassa, echinulata vel verrucoso-echinulata, pallide aureo-brunnea vel flavida, poris germinationis obscuris, sparsis vel plus minusve bizonatis, verosimiliter 8. Teliis urediniis similis sed atro-brunneis; capitulis teliosporarum (74-)80-110(-120) µm diametro, ex cellulis (6)7-9 (10) in omni directione compositis, castaneo-brunneis, quaque cellula cum tuberculum unicum 2-3.5 µm latus (2-)3-5(-6) µm altus, cellulis centralis (11-)13-18(-22) µm latis, cystidiis numerosis, multiseriatis, pendulis.

Holotype: on *Lysiloma candida* Brand., Los Encinos, Sierra Giganta, Baja California Sur, Mexico, 28 Feb. 1939, Gentry No. 4263 ex ARIZ 66230 (PUR 64928).

R. arizonica Ellis & Ever. also has one tubercle or spine per cell but it has urediniospores that mostly are 33-46 µm long and have equatorial pores.

Ravenelia floridana sp. nov. (Fig. 4)

Spermogoniis et aeciis ignotis. Urediniis epiphyllis, aggregatis, subepidermalibus, plus minusve indehiscentibus, paraphysibus nullis; sporis (24-)26-35(-40) x (15-)18-22(-24) µm, valde variabiles sed plerumque obovoideis, membrana ad laterum (2-)2.5-3.5(-4) µm crassa ad apicem (3.5-)5-7 (-9) µm crassa, aureo-brunnea vel fere hyalina, echinulata, poris germinationis (4)5 vel 6, aequatorialibus. Teliis urediniis conformibus; capitulis teliosporarum (55-)60-75 (-83) µm diametro, ex cellulis (3)4-6 in omni directione compositis, atro-brunneis, quaque cellula (0-)2-5(-6) spinae 3-6 x 2-3 µm ornatae, cellulis centralis (17-)19-24 (-26) µm latis, cystidiis eodem numero quo cellulis marginalibus, pendulis.

Holotype: on *Pithecellobium unguis-cati* (L.) Mart., Matheson's Hammock, Dade County, Florida, U.S.A., 23 Feb. 1922, Stevenson No. 1817 (PUR 6115).

This species is distinctive because of the irregular and thick-walled urediniospores. The side wall of the urediniospores of *R. pithecolobii*, *R. siderocarpi* and *R. multispinosa* is about 1.5-2 µm thick. Also see discussion under *R. alamosensis* and *R. linda*. This fungus has been treated previously as *R. pithecolobii* which, in addition to the thin-walled urediniospores, has central cells of the teliospore heads that are only 12-16(-18) µm across.

Ravenelia alamosensis sp. nov. (Fig. 6)

Spermogoniis et aeciis ignotis. Urediniis amphigenis, subcuticularibus, brunneis, paraphysibus nullis; sporis (16-)18-21(-23) x (11-)13-14(-15) µm, plerumque ellipsoideis, membrana 1.5(-2) µm crassa, cinnamomeo-brunnea vel aureo-brunnea, echinulata, poris germinationis 4-6 frequenter 5 vel 6, aequatorialibus. Teliis urediniis similis sed atro-brunneis; capitulis teliosporarum (48-) 60-80(-85) µm diametro, ex cellulis 5 vel 6 in omni directione compositis, castaneo-brunneis, quaque cellula 3-6 spinae 2.5-4(-5) µm longae ornatae, cellulis centralis 12-22 µm latis, cystidiis eodem numero quo cellulis marginalibus, adpressis.

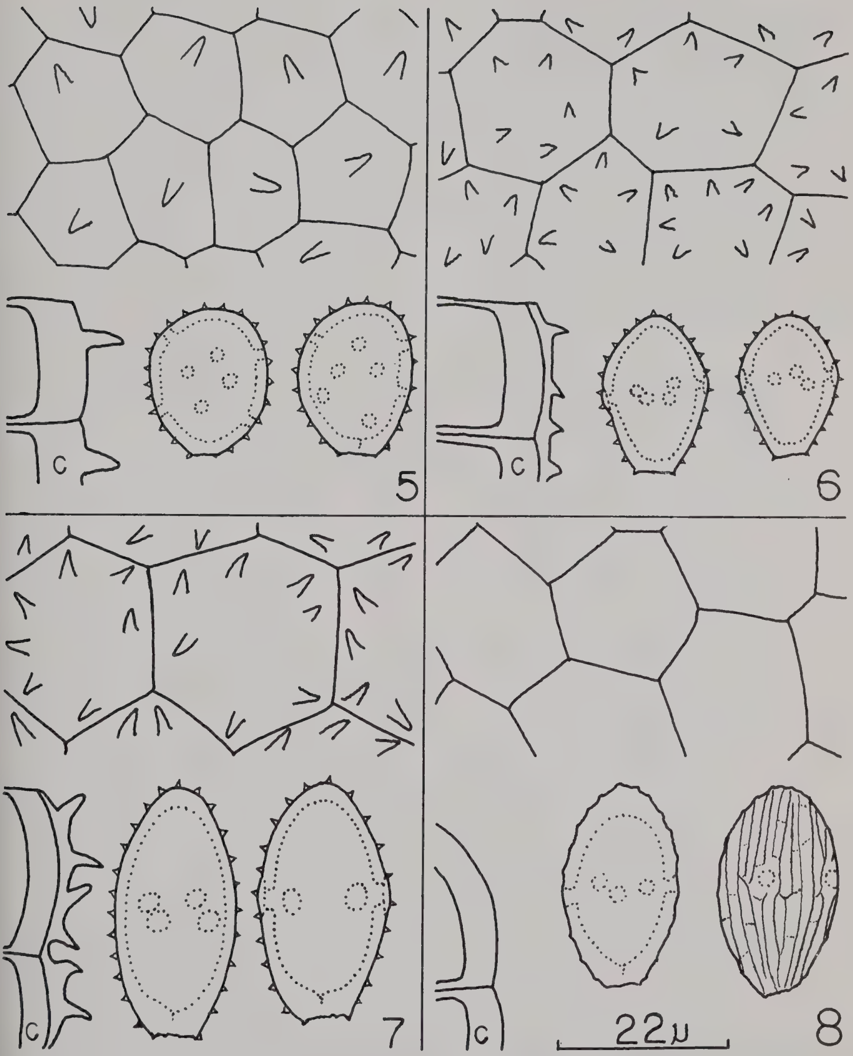
Holotype: on *Pithecellobium tortum* Mart., trail to Mt. Alamos, Alamos, Sonora, Mexico, 10 Oct. 1970, Cummins No. 70-106 (PUR 63539).

The fungus also occurs in Sinaloa State.

Including the new species, there are seven that parasitize *Pithecellobium* in North America. All have urediniospores with equatorial pores. Only *R. bifenestrata* Mains and *R. striatispora* have smooth teliospores. *R. alamosensis* has small urediniospores; the other four that have sculptured teliospores have urediniospores in the range of 26-35 µm long.

Ravenelia multispinosa sp. nov. (Fig. 7).

Spermogoniis et aeciis ignotis. Urediniis plerumque epiphyllis, subepidermalibus, cinnamomeo-brunneis, paraphysibus nullis; sporis (26-)29-35(-38) x (16-)18-21(-23) µm, ellipsoideis, membrana ad basim 2.5-3.5 µm crassa ad apicem 2-3 µm crassa ad laterum 1-1.5 µm crassa, obscure cinnamomeo-brunnea, echinulata, poris germinationis 4, equatorialibus. Teliis plerumque epiphyllis, atro-brunneis,



Figures 5-8. Species of *Ravenelia:* central cells of the teliospore head (top); margin of spore head (left); urediniospores (right). 5. *R. bajacalensis* on *Lysiloma*. 6. *R. alamosensis* on *Pithecellobium*. 7. *R. multispinosa* on *Pithecellobium*. 8. *R. striatispora* on *Pithecellobium*. (All from types and to the same scale.)

subepidermalibus; capitulis teliosporarum plerumque (60-) 65-85(-90) µm diametro, ex cellulis 4(5) in omni directione compositis, castaneo-brunneis, quaque cellula 5-10 spinae ornatae, cellulis centralis 22-30 µm latis, cystidiis eodem numero quo cellulis marginalibus, adpressis.

Holotype: on *Pithecellobium tortum* Mart., Sinaloa hgw 59 near km 86 e of El Fuerte, Sinaloa, Mexico, 6 Dec. 1971, Cummins 71-612 (PUR 64165).

This fungus also occurs in Baja California Sur and Sonora.

This species is generally similar to *R. siderocarpi* (on *Pithecellobium*), *R. linda* (on *Calliandra*) and *R. havanensis* (on *Enterolobium*) but they have subcuticular sori. *R. multispinosa* has more spines per teliospore than do other species on *Pithecellobium* but fewer than does *R. linda*.

Ravenelia striatispora sp. nov. (Fig. 8)

Spermogoniis et aeciis ignotis. Urediniis amphigenis, subepidermalibus, cinnamomeo-brunneis, pulverulentis, paraphysibus nullis; sporis (19-)21-25(-27) x (12-)13-15(-16) µm, plerumque ellipsoideis, membrana ad apicem et basem (2.5-)3-3.5(-4) µm crassa ad laterum (1.5-)2(-2.5) µm crassa, obscure aureo-brunnea, longitudinaliter striata, striae inter se (1.5-)2(-2.5) µm, poris germinationis (4)5 vel 6, aequatorialibus. Teliis non visis; capitulis teliosporarum 80-110 µm diametro, ex cellulis 5 vel 6 in omni directione compositis, castaneo-brunneis, levis, cellulis centralis (16-)18-22 µm latis, cystidiis eodem numero quo cellulis marginalibus, adpressis.

Holotype: on *Pithecellobium mexicanum* Rose, Comanito, Sinaloa, Mexico, 15 Mar. 1941, Gentry No. 5927 ex ARIZ 66892 (PUR 64929).

The longitudinally striated spores, which may have some fine cross connections, are unique. *R. corbula* J. W. Baxt. has spirally verrucose spores and paraphyses. It occurs on *Caesalpinia* (subfamily Caesalpinioideae).

Ravenelia verrucata sp. nov. (Fig. 9)

Spermogoniis et aeciis ignotis. Urediniis epiphyllis,

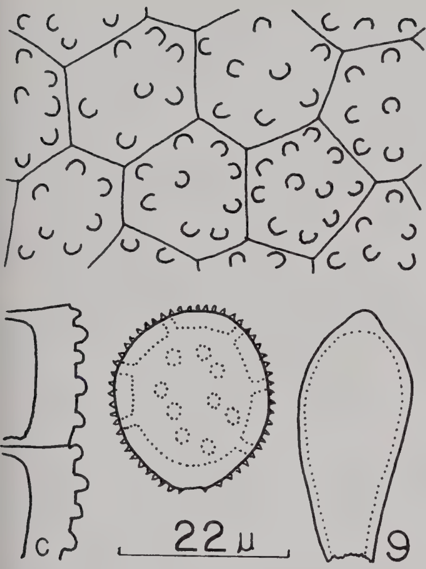


Fig. 9. *Ravenelia verrucata* on *Mimosa:* central cells of teliospore head (top); margin of spore head (left); one urediniospore and one paraphysis (right). (From type.)

flavo-brunneis, subcuticularibus, paraphysibus plerumque clavatis usque ad 14 µm latis, membrana uniformiter 1 µm crassa vel ad apicem usque ad 6 µm crassa, hyalina vel flavida; sporis (17-)19-22(-23) x (16-)17-19 (-20) µm, late ellipsoideae vel globoideae, membrana 2-2.5(-3) µm crassa, flavo-brunnea, densique verrucoso-echinulata, poris germinationis 10-15, sparsis. Teliis urediniis consociatis atro-brunneis, sine paraphysibus; capitulis teliosporarum 60-90 µm diametro, ex cellulis 4-7 in omni directione compositis, castaneo-brunneis, quaque cellula tuberculae (4-)7-11 ornatae, cellulis centralis (15-) 17-21 µm latis, cystidiis eodem numero quo cellulis marginalibus, adpressis vel semipendulis.

Holotype: on *Mimosa spirocarpa* Rose, Mex hgw 15, km 41 n of Mazatlan, Sinaloa, Mexico, 2 Dec. 1971, Cummins No. 71-591 (PUR 64152).

The species occurs also on *Mimosa guatemalensis* (Hook. & Arn.) Benth. and in Nayarit State.

R. verrucata differs from others on *Mimosa* because of the thicker wall and greater number of pores of the urediniospores, the nearly colorless, thin-walled paraphyses and the more numerous tubercles on the teliospores.

BOOK REVIEWS *(continued from page 194)*

fiés, laissant de côté toute tentative de revision taxonomique, de recherche ou de d'étude monographique.

Dans cette perspective, l'auteur s'est éfforcé de démentir cet aspect de la littérature botanique que, déjà en 1821, Purton (App. Midl. Fl. p. 335) regrettait en ces termes "The practice of accurately examining the synonyms, instead of copying them from other authors, has been too long neglected." Le contenu taxonomique de chaque taxon dénommé a été vérifié afin de certifier les synonymies et de dépister les mésapplications des noms à travers une littérature de plus de 200 ans. Grâce à un système original d'abréviation succinte, les innombrables références aux noms de genre ou d'espèce acceptée, à leurs synonymes et leurs mésapplications sont condensées dans une première partie (184 p.). Par ailleurs, la liste bibliographique se limite à une sélection de plus de mille publications relatives aux polypores européens.

Ensuite l'auteur propose ses remarques sur les taxa acceptés, non pas pour trancher le doute ou donner une interprétation, mais pour attirer l'attention du chercheur sur les problèmes taxonomiques latents (85 p.).

Enfin une très longue liste avec commentaire (103 p.) des noms génériques et spécifiques rejetés pour des raisons d'invalidité et de doute, et un index des noms et synonymes terminent l'ouvrage.

C'est le résultat d'un travail précis, patient et méthodique, la part la plus rebutante de la tache du taxonomiste. Bien qu'il ait regretté n'avoir pu s'étendre aux polypores extra-européens, le Dr. M.A. Donk a réalisé pour nous ce premier pas indispensable à toute future monographie des polypores.

THE TREE RUSTS OF WESTERN CANADA, by Wolf G. ZILLER, Canadian Forestry Service Publication n° 1329, viii + 272 p., 157 figs., Victoria, 1974. Obtainable from Information Canada, Ottawa K1A 0S9. Canadian $5.00.

L'auteur a assemblé dans ce livre toute l'information publiée à ce jour et le fruit de ces 25 années de recherches personnelles sur les rouilles (Urédinales) et les maladies qu'elles causent aux arbres dans le Canada occidental. Il fournit les descriptions taxonomiques et les clés d'identification de 70 espèces. Il en donne le cycle évolutif illustré dans des diagrammes en spirale, la pathogénie, l'épidémiologie, la distribution géographique et les hôtes. Il ajoute des notes sur les moyens de lutte. Illustré d'excellentes photographies couleurs et de microphotos, le livre est rendu plus accessible encore grâce à un glossaire des termes techniques. Utile aux spécialistes, ce livre intéressera aussi les mycologues, naturalistes et forestiers.

MYCOLOGIST'S HANDBOOK, par D.L. HAWKSWORTH, recensé dans MYCOTAXON 1(3): 238, 259, peut aussi être obtenu en version brochée à £ 2.75.

MYCOTAXON

Vol. II, No. 1, pp. 205-208 April-June 1975

DEUX NOUVEAUX HAMASPORA (UREDINALES) DE L'HIMALAYA

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L'examen de matériel récemment collecté au Népal (1) m'a révélé la présence de parasites du genre *Hamaspora* sur un certain nombre de *Rubus*. Ces récoltes sont particulièrement intéressantes puisque ces Urédinales n'étaient pas connues dans l'Himalaya (DURRIEU). D'autre part deux d'entre elles présentant des téliospores, leur détermination était possible, or elles ne correspondent à aucune des espèces actuellement décrites (MONOSON).

Hamaspora dobremezii n. sp.

Sur *Rubus fockeanus* KURZ., forêt dans la vallée de Lantang, en aval de Gora Tabela, vers 2800 m, 26 mai 1974.

Urédos inconnus. Téliosores situés à la face inférieure des feuilles, souvent en groupe, formant des filaments très contournés, atteignant 7 mm de long et 0,2 mm de diamètre, jaune pâle ou blancs. Les téliospores (fig. 1) sont cylindriques, atténuées en longue pointe à partir de la moitié ou du tiers supérieur. Elles comportent 4 (dans 56% des cas) ou 5 cellules (dans 40% des cas), bien plus rarement (4%) 3 seulement. Elles mesurent de 120 à 183 µm de long (et parfois jusqu'à 202 µm) et de 13 à 18 µm de diamètre. Leur paroi est mince, sauf à l'apex où elle s'épaissit pour former une pointe de 5 à 9 µm, rarement jusqu'à 12 µm . La cellule terminale est souvent 2 à 3 fois plus longue que les autres. Ces téliospores germent sur place mais il n'y a pas de pore germinatif visible.

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(1) La récolte de ce matériel a été réalisée au cours d'une mission effectuée dans le cadre de la RCP 253 "Ecologie et Géologie de l'Himalaya central" du C.N.R.S.

La présence d'urédospores dans le cycle n'est pas impossible du fait de l'observation d'une téliospore anormale (fig. 2) dont la cellule terminale a l'aspect d'une urédospore. Mais il peut s'agir d'une anomalie sans signification sur le cycle actuel du parasite, car il faut aussi tenir compte que la date de la récolte (mai) est relativement précoce, donc si l'espèce n'était pas microcyclique il aurait été normal de trouver d'autres formes de sporulation que les seules téliospores.

Comparée aux autres espèces d'*Hamaspora*, celle dont *H. dobremezii* semble la plus voisine est *H. taiwaniana* HIRATS. et HASH., mais ses téliospores sont formées de 4 à 6 cellules (5 le plus souvent) et sont plus courtes : 113 - 178 µm.

Je suis heureux de dédier cette espèce au botaniste grenoblois J.F. DOBREMEZ en amical hommage à son oeuvre botanique au Népal.

Uredia ignota. Telia numerosa, solitaria vel caespitosa ; filiformia. 7 x 0,2 mm, pallido-flavida vel albida. Teliosporae cylindraceae, dimidia superiore attenuatae, acutae, 3 aut 4-septatae (raro 2-septatae) 120-183 (202 µm) x 13-18 µm ; epispora levis, tenuis, apice incrassata 5-9 (12 µm). Holotypus : in foliis vivis Rubi fockeani KURZ., Nepal, prope Gora Tabela 2800 m in Langtang valle 26/6/1974, G. DURRIEU, T.L.A.
Nomen in honorem J.F. DOBREMEZ vegetationis nepalensis investigatoris.

Hamaspora nepalensis n. sp.
Sur *Rubus biflorus* BUCH.-HAM., vallée de la Seti Khola en amont de Bharbhare, 1700 m, 11 mai 1974.

Les urédospores et téliospores naissent successivement dans les mêmes sores, qui sont petits et dispersés à la face inférieure des feuilles. Les urédospores (fig. 3) hyalines, ovoïdes ou sphériques mesurent 22-30 x 19-27 µm. Elles sont couvertes de fortes épines coniques, excepté une

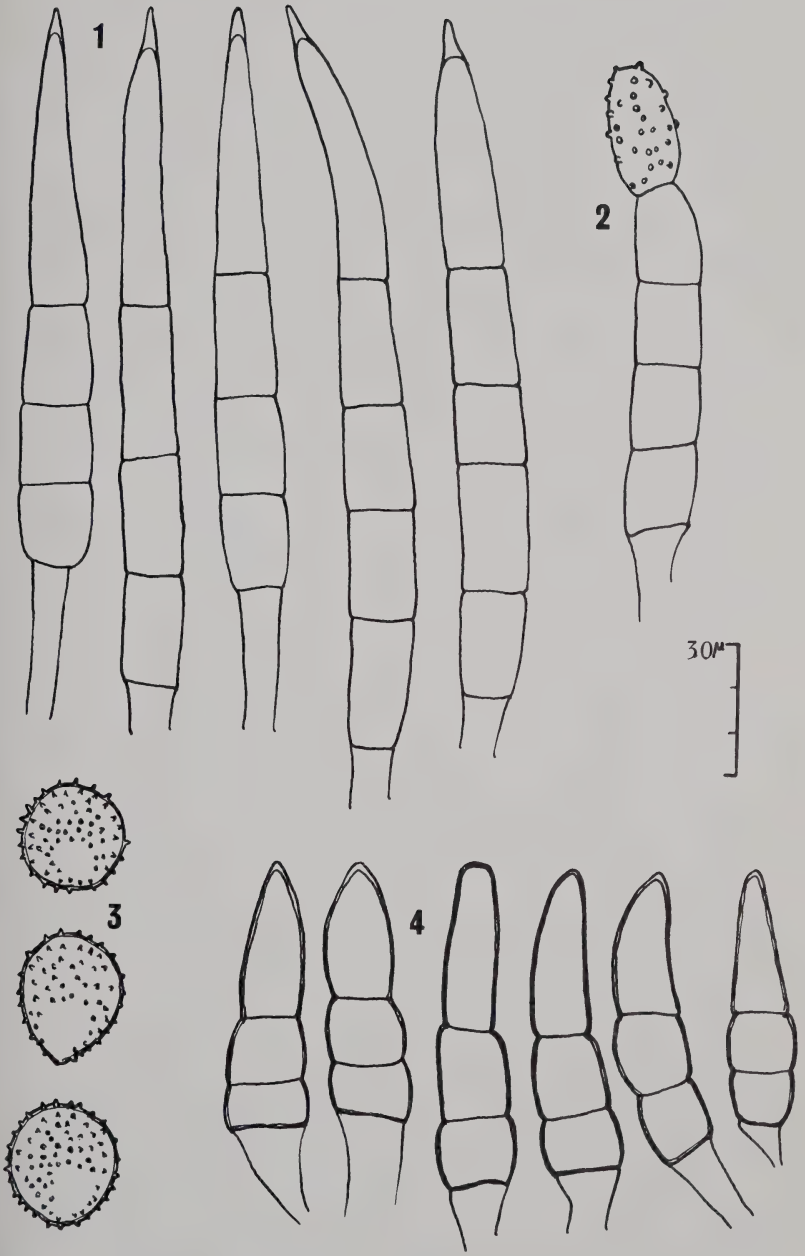

Fig. 1 - *Hamaspora dobremezii* : téliospores. Fig. 2 - *H. dobremezii* : téliospore anormale. Fig. 3 - *H. nepalensis* : urédospores. Fig. 4 - *H. nepalensis* : téliospores.

plage basale lisse qui correspond peut-être à l'emplacement d'un pore germinatif. Ces épines mesurent 2 µm de haut, elles sont plus fortes vers la partie apicale que vers la base et sont espacées de 2,5 à 4 µm . La paroi est mince ; de 0,75 à 1 µm.

Les téliospores (fig. 4), hyalines, sont agglomérées en filaments courts, ne dépassant pas 1 mm. Elles sont fusiformes, arrondies ou subarrondies à l'extrémité, tricellulaires (très rarement bicellulaires), rétrécies de façon notable au niveau des cloisons. Leur longueur varie entre 60 et 80 µm , leur diamètre entre 18 et 24 µm. La paroi est mince, inférieure ou égale à 1 µm, elle peut être légèrement épaissie à l'apex : 2 à 3 µm , qui ne forme jamais un apicule plein comme c'est le cas de beaucoup d'autres espèces. La cellule terminale atteint trois fois la longueur de la basale.

Cette Rouille ne se rapproche d'aucune espèce connue d'*Hamaspora*. Par les dimensions des téliospores elle pourrait sembler voisine de *H. hashiokai* (3-cellulaires : 50-85 x 12-19 µm), mais l'épaississement apical y est bien plus net et les dimensions des urédospores sont largement supérieures : 32-56 x 12-42 µm .

Uredosporae et teliosporae in eisdem soris. Uredosporae hyalinae, ovatae vel sphericae, 22-30 x 19-27 µm echinatae, spinae ca. 2 µm altae, 2,5-4 µm distantes, epispora 1 µm crassa. Teliosporae hyalinae, fusiformes apice rotundatae vel subrotundatae, plerumque biseptatae, ad septa constrictae, 60-80 x 18-24 µm , epispora tenuissima apice non vel vix incrassata (3 µm).

Holotypus in foliis vivis Rubi biflori BUCH.-HAM., *Nepal in Seti khola valle prope Bharbhare, 1700 m, 17-5-1974*
G. DURRIEU - T.L.A.

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GYMNOMYCES MONOSPORUS SP. NOV.

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The genus *Gymnomyces* is differentiated from others in the astrogastraceous Gasteromycetes by having amyloid spore ornamentation and sphaerocysts in the mediostratum of the tramal plates but lacking both latex and a stipe columella. Seven species have hitherto been found in North America (Singer & Smith 1960). In western Oregon we recently collected a strikingly distinct, new species.

Colors of sporocarps were determined by use of Ridgway (1912), but color names are given as the ISCC-NBS near synonyms (Kelly & Judd 1955). Anatomical features were described from sections mounted in 5% KOH, Melzer's reagent, and cotton blue-lactic acid. Collections are deposited in the Mycological Herbarium of Oregon State University (OSC).

GYMNOMYCES MONOSPORUS Stewart & Trappe sp. nov. Figs. 1-2.

Fructificationes vivae 9-25 x 9-35 mm, subglobosae vel irregulares. Peridium persistens, levis, album, dein roseum vel roseo-brunneum. Gleba lutea, columella nulla. Sporae 15-21 x 12-18 µm, subglobosae vel ellipsoideae, spinis 1.5-3(-5) x 0.5-1 µm. Basidia monospora, 30-35 x 11-16 µm. Cystidia 35-47 x 7-12 µm. Holotypus: Oregon, Benton County, Trappe 3979 (OSC).

Sporocarps 9-25 x 9-35 mm fresh, 7-19 x 7-29 mm as dried, subglobose to irregular, depressed at the base. *Peridium* thin, persistent, felty-smooth to alveolate (depressed over glebal chambers), white, staining pink to grayish red where bruised, drying light brown, not reacting to 5% KOH, 5% $FeSO_4$, ethanol, or Melzer's reagent. Gleba pale yellow in youth, becoming light orange yellow and, at maturity, dingy orange yellow, drying light yellowish brown; chambers 0.2-0.5 mm diam, rotund; columella lacking, but one to several narrow, sterile veins radiating from sporocarp base. Odor fragrant.

Spores 15-21 x 12-18 µm excluding ornamentation, subglobose to broadly ellipsoid. Walls 1.5-2(-3) µm thick, pale yellow in KOH, dull yellow in Melzer's reagent (walls nonamyloid), cyanophilous in cotton blue-lactic acid. Ornamentation of hyaline rods and spines 1.5-3(-4) x 0.5-1 µm, occasionally with light to heavy amyloid deposits near the base as dots or collars (the amount of amyloid deposits varying markedly from spore to spore), strongly cyanophilous in cotton blue-lactic acid; sterigmal appendage 3-4 x 2-3 µm, inconspicuous, often with a basal amyloid collar.

Basidia 30-35 x 11-16 µm, thin-walled, broadly clavate, with a single, prominent sterigma, mostly with granular content in KOH. *Cystidia* 35-47 x 7-12 µm, obtuse-ventricose, thin-walled, with granular content in KOH, scattered, extending 12-25 µm beyond other hymenial elements. *Brachybasidioles* 25-35 x 14-19 µm, thin-walled, the contents clear in KOH. *Subhymenium* of 1-3 tiers of sphaerocyst-like cells mostly 9-25 x 6-15 µm. *Tramal mediostratum* of subparallel hyphae 2-5 µm diam with scattered single to clustered sphaerocysts. *Peridium* 150-300 µm thick, of interwoven, hyaline hyphae 2-3(-4) µm diam, sphaerocysts scattered in tissue adjacent to gleba; no clamp connections found.

HOLOTYPE: Oregon, Benton County, T. 13 S., R. 6 W., NW¼ of SW¼ Sec. 31, hypogeous in old roadbed in woods of 20-30 year-old *Pseudotsuga menziesii* (Mirb.) Franco; 23 July 1974, Trappe 3979 (OSC). PARATYPE: Same location as holotype; 23 July 1974, Stewart 2004 (OSC).

Gymnomyces monosporus is the only species of the genus with exclusively one-spored basidia. In addition, it has larger spores than any other species currently assigned to the genus. One other large-spored species, *G. roseomaculatus* Singer & Smith, is reported to stain pink where bruised. The two species can be readily separated by these

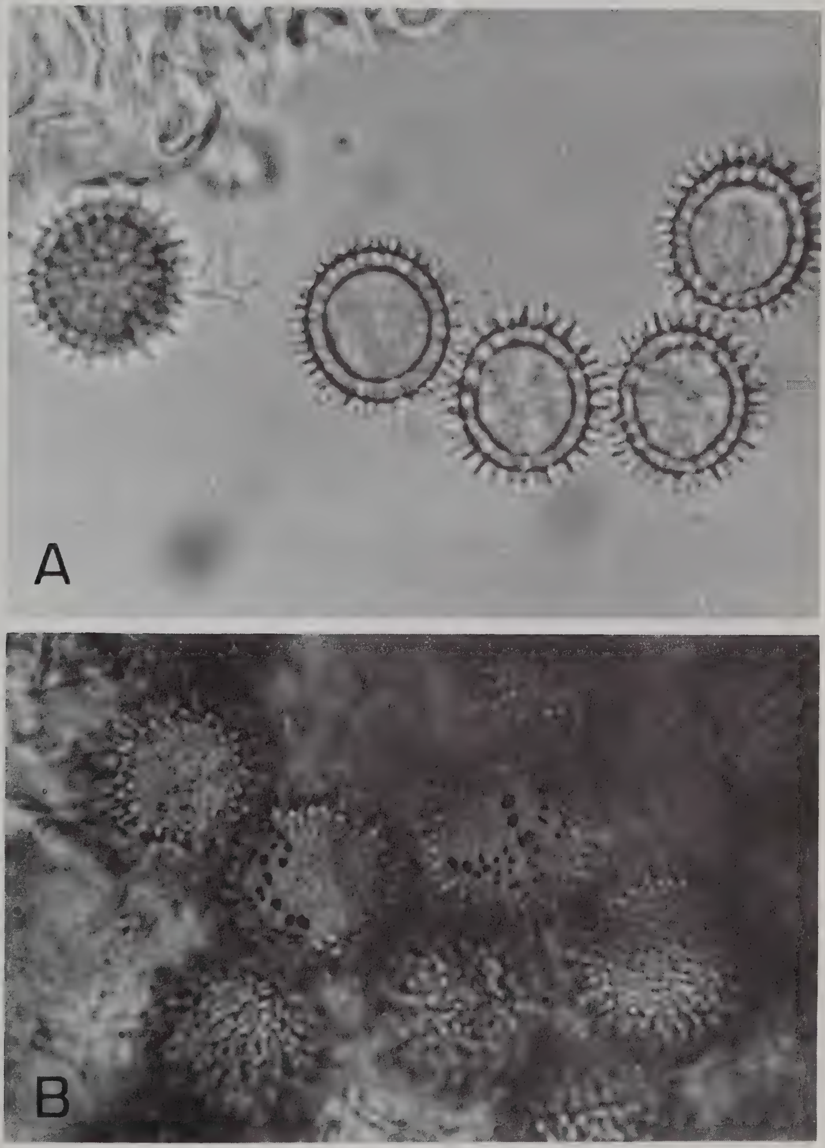

Fig. 1. *Gymnomyces monosporus* spores, x 1,000 in Melzer's reagent: (A) Optical cross-section; (B) Surface view showing amyloid deposits.

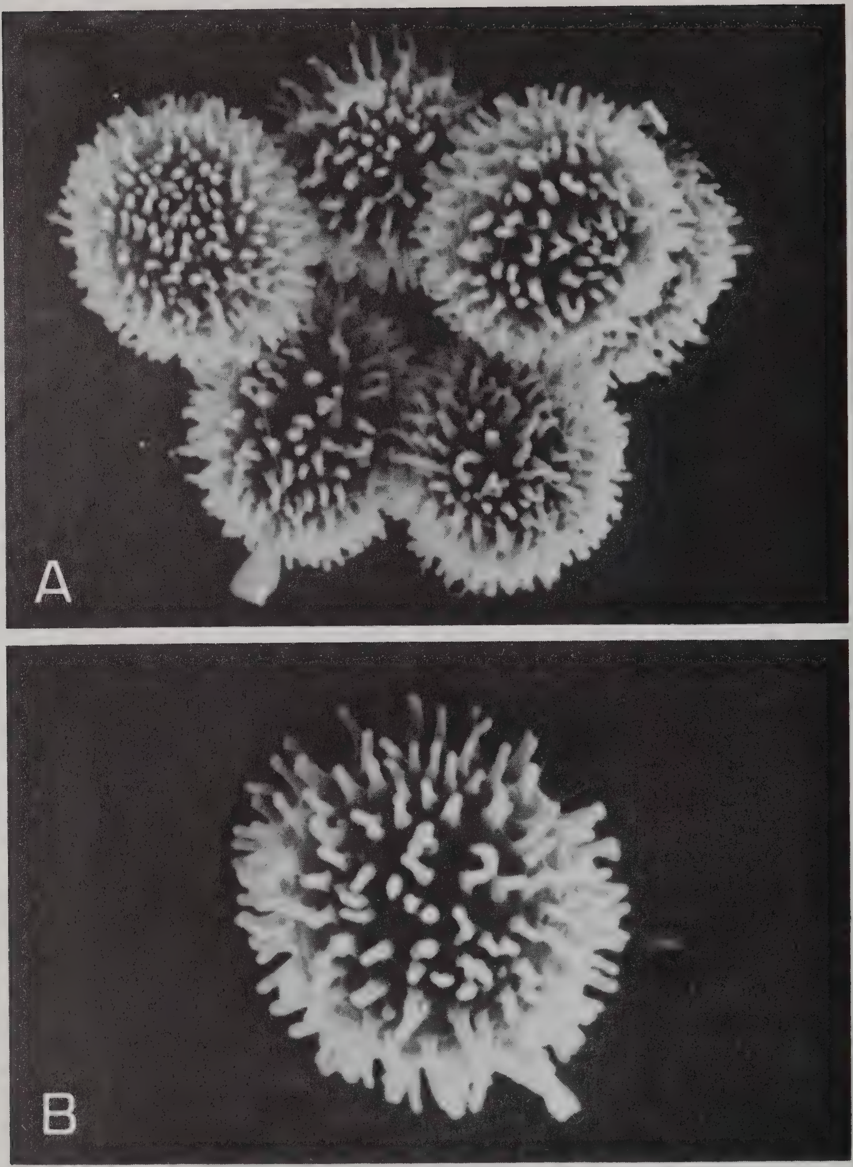

Fig. 2. *Gymnomyces monosporus* spores, scan electron micrographs: (A) Spore group, x 2,000; (B) Single spore, x 3,000.

characters, as described earlier in this paper and by Singer & Smith (1960), respectively:

	G. monosporus	*G. roseomaculatus*
Spores per basidium	1	2
Spore size	15-21 x 12-18 µm	14-17 x 12-16 µm
Spore ornamentation	1.5-3(-4) x 0.5-1 µm	1-1.5 x 0.6-1 µm
	amyloid deposits at base of some	strongly amyloid
Spore wall thickness	1.5-2(-3) µm	thin

This study was supported in part by National Science Foundation Grant GB27378.

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GENICULIFERA RIFAI NOM. NOV.

MIEN A. RIFAI

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SUMMARY

Since *Genicularia* Rifai & R.C. Cooke 1966 represents a later homonym of the algal generic names *Genicularia* de Bary 1858 and *Genicularia* Rouss. ex Desv. 1808, the new name *Geniculifera* Rifai is proposed to replace it. Key to the species accepted in this genus is presented and seven new combinations are made.

Dr. Barbara L. Newton of the Michigan State University kindly drew my attention to the fact that *Genicularia* Rifai & R.C. Cooke 1966 is a later homonym of the algal generic name *Genicularia* de Bary 1858, which currently is used in phycological literatures. In studying this matter it turns out that there is another algal genus *Genicularia* Rouss. ex Desv. 1808 which de Toni (1905) reduced to the synonymy of *Audouinella* Bory 1823. Whether or not *Genicularia* de Bary will have to be conserved should be decided by students of algae, but it is obvious that *Genicularia* cannot be used for certain species of nematode trapping Hyphomycetes. Consequently the new generic name *Geniculifera* Rifai is proposed here to accommodate those species which Rifai & Cooke (1966), Rifai (1968), Barron (1968) and Barnett & Hunter (1972) classified in *Genicularia*.

In contrast with the much adopted practice of recognizing genera of Hyphomycetes based solely on the number of spore septation, Rifai (1968) widened the generic limits of *Genicularia* to cover not only the species with two-celled conidia but also those with many septate conidia. *Geniculifera* is intended to encompass this emended generic concept, a description of which is presented below.

GENICULIFERA Rifai, nom. nov.

Genicularia Rifai & R.C. Cooke *in* Trans. Brit. mycol. Soc. 49 : 153. 1966, emend. Rifai *in* Reinwardtia 7 : 366. 1968; Barron, *Gen. Hyphom. Soil* : 169. 1968; *non Genicularia* de Bary, *Unters. Fam. Conjug. (Zygnem. & Desmid.)* : 26. 1858; *nec Genicularia* Rouss. ex Desv., *Journ. Bot*. 1 : 143. 1808.

In pure culture colonies grow quite rapidly, effused, pale pink to whitish. Mycelium composed of septate, hyaline, smooth walled, branched hyphae which mostly form thin and sparse mat over the surface of the media, with scanty aerial growth. Conidiophores arise from creeping or submerged hyphae, hyaline, smooth walled, septate, erect or ascending, at first straight, becoming geniculate or flexuous, elongating—sometimes considerably—by repeated subapical renewal of growth. Conidiogenous cells terminal, integrated, generally polyblastic, sympodial and geniculate, with broad, terete or hardly conical denticles of various length. Conidia solitary, acrogenous on young conidiophores, later acropleurogenous, short obpyriform, obpyriform to obovoid-turbinate or broadly fusoid ellipsoidal, 1—many-septate, the basal cell usually obconical and truncate, hyaline when viewed singly but appearing pale pinkish white in mass, smooth walled.

Habitat and distribution: mostly capturing and parasitizing nematodes by means of various kinds of traps in soil or debris, cosmopolitan.

Type species: *Trichothecium cystosporium* Duddington.

KEY TO RECOGNIZED SPECIES OF *GENICULIFERA*

1a. Conidia typically 1-septate 2
b. Conidia typically 1-many-septate 4
2a. Conidia sparsely formed on each conidiophore, narrowly obpyriform, 24—40x12—19 µm .... *G. paucispora*
b. Conidia profusely formed on each conidiophore, obpyriform 3
3a. Conidia 24—32.5x12.5—20 µm; trapping apparatus consists of adhesive three-dimensional system of organ .... *G. cystosporia*
b. Conidia 24—35x18—25 µm; trapping apparatus consists of adhesive, simple lateral branch .... *G. perpasta*
4a. Conidia 1—3 (mostly 2)-septate 5
b. Conidia 1—4 (mostly 3)-septate 6
5a. Conidia broadly obclavate, often unequal sided to slightly curved, 25—40x7.5—19 µm .... *G. clavispora*
b. Conidia obpyriform, 32.5—50x14—22.5 µm .... *G. bogoriensis*
6a. Conidia fusoidal, 46—71x21—29 µm .... *G. psychrophila*
b. Conidia obovoid turbinate, 37—55x21—35 µm ... *G. eudermata*

Geniculifera paucispora (R.C. Cooke) Rifai, comb. nov.

Genicularia paucispora R.C. Cooke *apud* Rifai & R.C. Cooke *in* Trans. Brit. mycol. Soc. 49: 157. 1966 (basionym).

Geniculifera cystosporia (Duddington) Rifai, comb. nov.

Trichothecium cystosporium Duddington *in* Trans. Brit. mycol. Soc. 34: 600. 1951 (basionym). — *Arthrobotrys cystosporia* (Duddington) Mektieva *in* Dokl. Akad. Nauk azerb.SSR.20(6): 70. 1964 (ut *Arthrobotrys cystosporium*). — *Genicularia cystosporia* (Duddington) Rifai & R.C. Cooke *in* Trans. Brit. mycol. Soc. 49: 154. 1966.

Geniculifera perpasta (R.C. Cooke) Rifai, comb. nov.

Genicularia perpasta R.C. Cooke *apud* Rifai & R.C. Cooke *in* Trans. Brit. mycol. Soc. 49: 156. 1966 (basionym).

Geniculifera clavispora (R.C. Cooke) Rifai, comb. nov.

Dactylaria clavispora R.C. Cooke *in* Trans. Brit. mycol. Soc. 47: 307. 1964 (basionym). — *Genicularia clavispora* (R.C. Cooke) Rifai *in* Reinwardtia 7: 367. 1968.

Geniculifera bogoriensis (Rifai) Rifai, comb. nov.

Monacrosporium cystosporum R.C. Cooke & Dickinson *in* Trans. Brit. mycol. Soc. 48: 623. 1965 (basionym). — *Genicularia bogoriensis* Rifai *in* Reinwardtia 7: 367. 1968; *non* *Genicularia cystosporia* (Duddington) Rifai & R.C. Cooke, *nec* *Geniculifera cystosporia* (Duddington) Rifai.

Geniculifera psychrophila (Drechsl.) Rifai, comb. nov.

Dactylaria psychrophila Drechsl. *in* Mycologia 36: 161. 1944 (basionym). — *Monacrosporium psychrophilum* (Drechsl.) R.C. Cooke & Dickinson *in* Trans. Brit. mycol. Soc. 48: 622. 1965 — *Genicularia psychrophila* (Drechsl.) Rifai *in* Reinwardtia 7: 367. 1968.

Geniculifera eudermata (Drechsl.) Rifai, comb. nov.

Dactylaria eudermata Drechsl. *in* Mycologia 42: 40. 1950 (basionym). — *Monacrosporium eudermatum* (Drechsl.) Subram. *in* J. Indian bot. Soc. 42: 293. 1963. — *Genicularia eudermata* (Drechsl.) Rifai *in* Reinwardtia 7: 367. 1968.

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NEW XANTHOPARMELIA (LICHENES: PARMELIACEAE) RECORDS FROM NEW MEXICO

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Summary

Xanthoparmelia ajoensis and *X. wyomingica* are reported for the first time from New Mexico, and new localities for *X. psoromifera* are listed. The new combinations *Xanthoparmelia ajoensis* (Nash) Egan, *Xanthoparmelia tucsonensis* (Nash) Egan, and *Xanthoparmelia huachucensis* (Nash) Egan are made.

The southwestern United States has a great diversity of *Xanthoparmelia* species. Egan (1972) and Nash (1974a) report a total of 16 taxa for New Mexico. This paper reports two additional *Xanthoparmelia* species for New Mexico and lists new localities for *X. psoromifera* (Kurok.) Hale. All specimens cited are deposited in my private herbarium at Texas A&M University and many duplicates have been distributed. Nomenclature follows recent changes proposed by Hale (1974).

1. *XANTHOPARMELIA AJOENSIS* (Nash) Egan, comb. nov. Basionym: *Parmelia ajoensis* Nash, Bryologist 77: 234. 1974.

While studying recent collections of *Xanthoparmelia* from New Mexico, I found specimens of *X. ajoensis* from the Manzano Mountains southeast of Albuquerque. Nash (1974b) reported only two localities for this species, one from Arizona (holotype) and one from the state of Sonora in Mexico (paratype). The collection listed below represents the third reported locality and greatly extends the known range of this species.

X. ajoensis (Fig. 3) is characterized by the presence of isidia, a pale to brown lower cortex and the occurrence of diffractaic acid in the medulla. Diffractaic acid in the New Mexico material was detected by thin-layer chromatography following the methods outlined in Culberson (1972). TLC plates show the presence of two unknown compounds accompanying the usnic and diffractaic acids. A strong CK+ orange medullary reaction as described by Dey (1974) from *Parmelia diffractaica* is easily seen in the specimens of *Xanthoparmelia ajoensis* from New Mexico.

Diffractaic acid is known from only one other *Xanthoparmelia* species, *Xanthoparmelia tucsonensis* (Nash) Egan, comb. nov. (Basionym: *Parmelia tucsonensis* Nash, Bryologist 77: 234. 1974) This species lacks the isidia characteristic of *X. ajoensis* and is known from only the type locality near Tucson, Arizona.

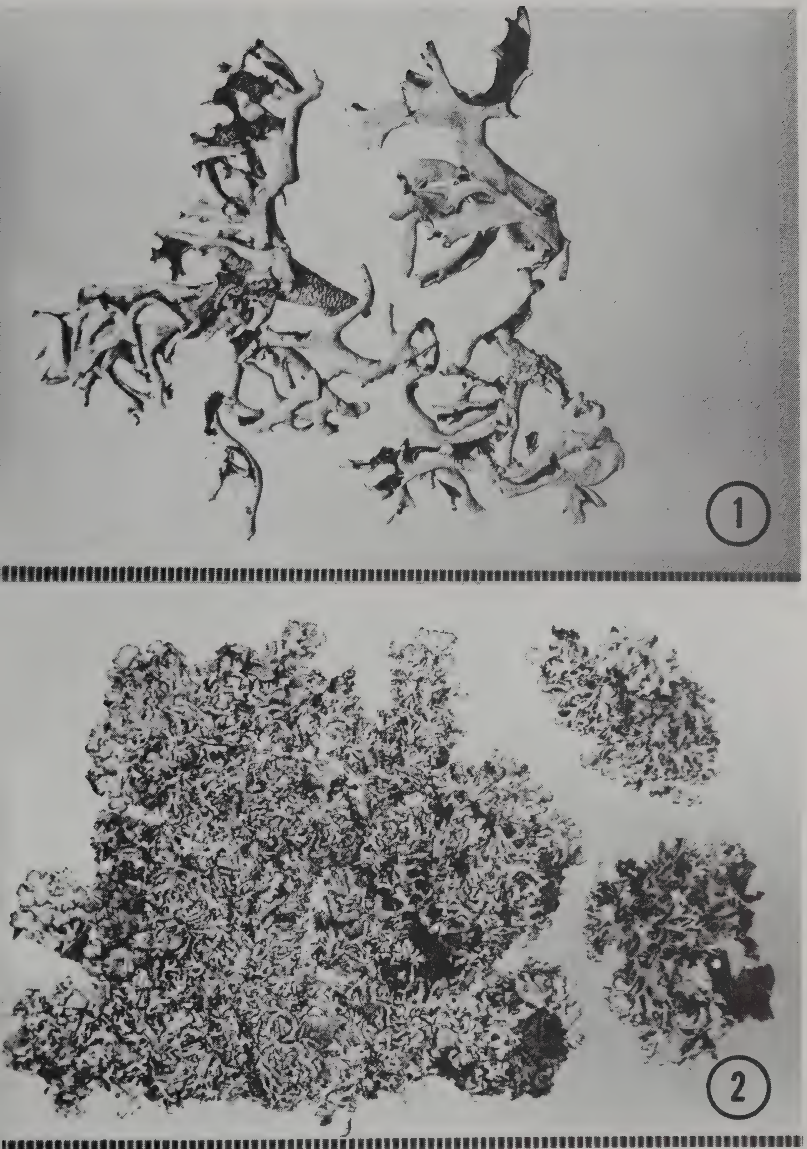
Specimen seen. New Mexico. TORRANCE COUNTY: vicinity of Fourth of July Campground, Cibola National Forest, Manzano Mountains, 2 miles northwest of Tijique, elev. 7,400 ft., on microcrystalline limestone, August 1970, *Egan El-6823.*

2. *XANTHOPARMELIA WYOMINGICA* (Gyeln.) Hale, Phytologia 28: 490. 1974. *Parmelia digitulata* var. *wyomingica* Gyeln., Ann. Mycol. 36: 277. 1938.

X. wyomingica has a growth form and chemistry similar to *X. chlorochroa* (Tuck.) Hale but seems to represent a high elevation counterpart in the Rocky Mountains. It is most abundant on soil and rocks above timberline and is the most frequently collected *Xanthoparmelia* in the alpine zone of New Mexico and Colorado. *X. chlorochroa* and *X. wyomingica* are seldom sympatric since *X. chlorochroa* normally occurs at lower altitudes on bare soil on the grasslands of the Great Plains. However, I have discovered populations of both species on soil in a high mountain valley near Dillon, Colorado. Figs. 1 and 2 show representative specimens of *X. wyomingica* and *X. chlorochroa* from New Mexico. *X. wyomingica* is generally characterized by very narrow lobes which are discrete when collected on soil or alpine vegetation but are often matted when collected on rocks. The species lacks isidia and the lower surface ranges from tan to dark brown. Usnic and salazinic acids are always present.

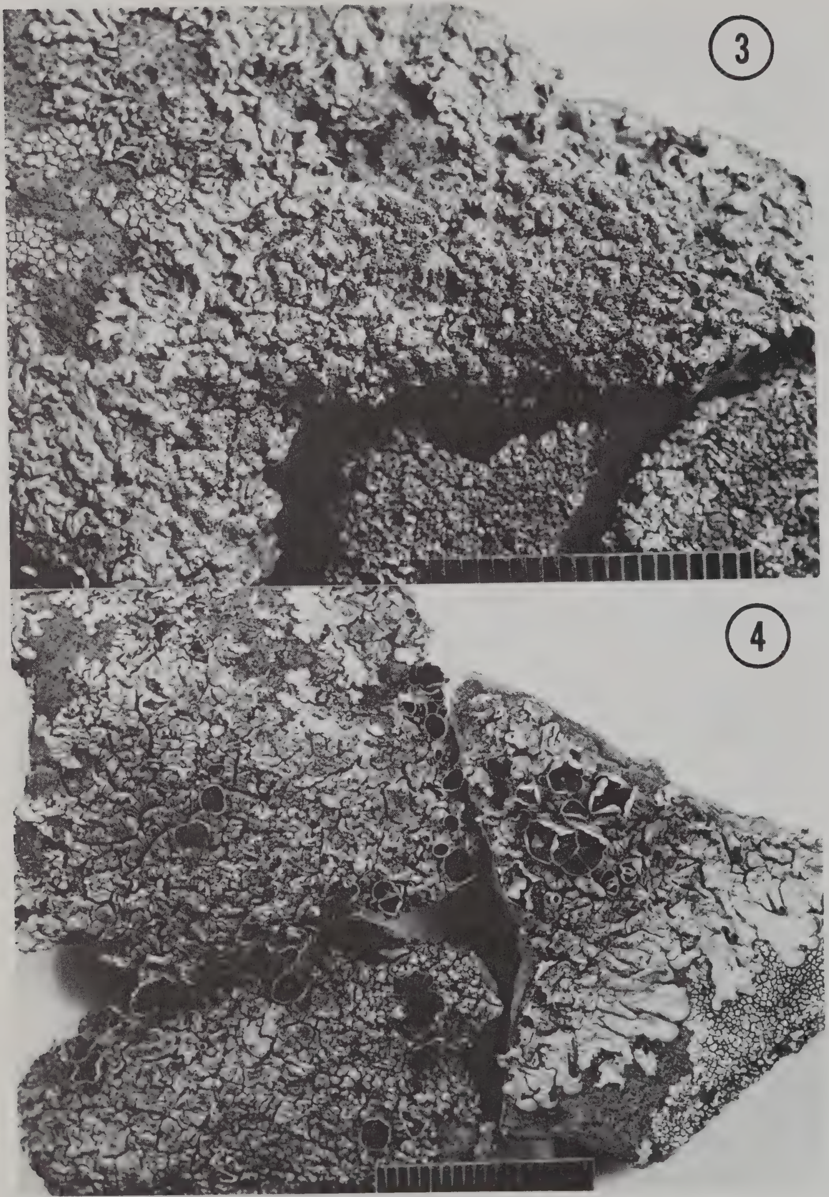
ERRATA TO VOLUME TWO

Page 219, Fig. 1 is *Xanthoparmelia chlorochroa* and Fig. 2 is *X. wyomingca*.



Figures 1-2. *Xanthoparmelia* from New Mexico: 1, *X. wyomingica* (Gyeln.) Hale; 2, *X. chlorochroa* (Tuck.) Hale. Scale is in mm.

SEE ERRATA



Figures 3-4. *Xanthoparmelia* from New Mexico: 3, *X. ajoensis* (Nash) Egan; 4, *X. psoromifera* (Kurok.) Hale. Scale is in mm.

The salazinic acid producing, non-isidiate *Xanthoparmelia* taxa represent a highly variable group in the southwestern United States, and many of the species intergrade. Much more work must be done before all taxa are satisfactorily characterized.

Specimens seen. New Mexico. SANTA FE COUNTY: Lake Peak, 11 miles northeast of Sante Fe, alpine tundra, elev. 12,300 ft., *Egan El-1325A, El-1609, El-2527;* the same, *Mitchell* (HERB. EGAN); TAOS COUNTY: La Cal Basin, 1.5 miles north of Wheeler Peak, alpine tundra, elev. 12,400 ft., *Egan El-1202, El-2347, El-2388;* the same, *Mitchell* (HERB. EGAN).

3. *XANTHOPARMELIA PSOROMIFERA* (Kurok.) Hale, Phytologia 28: 488. 1974. *Parmelia psoromifera* Kurok., Bull. Nat. Sci. Mus. Tokyo 10: 374. 1967.

Hale (1967) reported a single collection of *X. psoromifera* (Fig. 4) from the United States from a locality north of Española, New Mexico. Since that report I have made several other collections of *X. psoromifera* in the state. Thin-layer chromatography of all specimens shows the presence of usnic, psoromic, and conpsoromic acids. The lower surface of *X. psoromifera* is tan to brown, and the species lacks isidia of the chemically similar *X. kurokawae* (Hale) Hale. *Xanthoparmelia huachucensis* (Nash) Egan, comb. nov. (Basionym: *Parmelia huachucensis* Nash, Bryologist 76: 214. 1973) is chemically and morphologically similar but has a black lower cortex. All species grow on rocks.

Specimens seen. New Mexico. LINCOLN COUNTY: 2 miles east of Capitan, elev. 6,400 ft., on quartzite, *Egan & Shushan El-2436, El-2437;* RIO ARRIBA COUNTY: south of San Antonio Mountain about 12 miles north of Tres Piedras; elev. 8,700 ft., on basalt, *Egan El-6826;* TAOS COUNTY: about 7 miles southeast of Tres Piedras, elev. 7,400 ft., on basalt, *Egan El-6829.*

Acknowledgements

I thank Dr. Thomas Nash, III for his verification of *Xanthoparmelia ajoensis*, Dr. Mason E. Hale, Jr. for his comments on the manuscript, and Mr. Andrew Raiford for identification of the rock types.

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MYCOTAXON

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THE MYXOMYCETES OF COSTA RICA[1]

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SUMMARY

This is the first comprehensive paper on the Myxomycetes of Costa Rica encompassing a total of 91 species collected in that country between 1963 and 1967 by the second author and including a few specimens collected by others at approximately the same period of time. No new species are described but a few of those included have been rarely collected before anywhere. Thus, the specimen of *Badhamia cinerascens* Martin, is the second world collection of that species, and that of *Lamproderma muscorum* (Lev.) Hagelst. is one of the most typical of the species ever found. Other interesting finds include: *Ceratiomyxa morchella* Welden, *Tubifera bombarda* (Berk & Br.) Martin, *Comatricha subcaespitosa* Peck, the second collection of this species from the tropics, *Physarum citrinum* Schum. and *Physarum dictyosporum* Martin, the first collection of

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this species outside the United States.

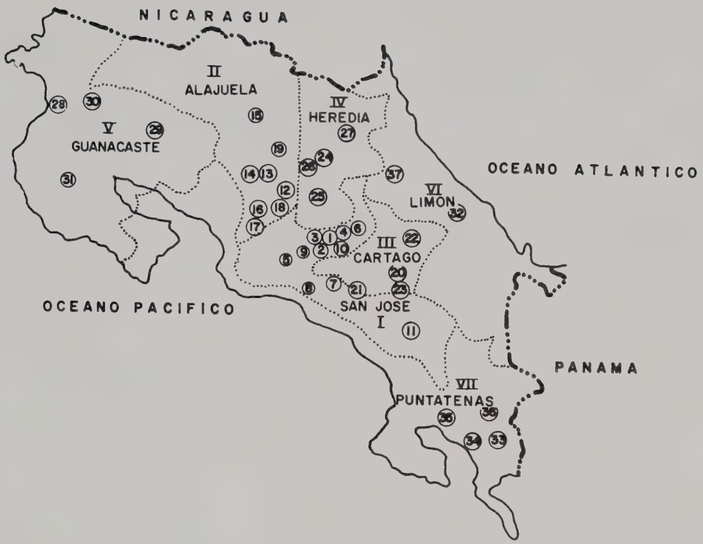
The genus Diachea is transferred to the Didymiaceae, following Farr's (1974) suggestion, supported by Blackwell's (1973, 1974) work.

INTRODUCTION

Relatively little is known about the Myxomycetes of Costa Rica. Although a few specimens have been collected in that country from time to time, most mycologists had largely neglected these organisms until Martin and Welden undertook an expedition to Panama and Costa Rica in the summer of 1952 and Welden (1954) published a list of Myxomycetes from these two countries in which he also included specimens which had been collected in Costa Rica by C. W. Dodge. Welden's paper lists 15 species from Costa Rica.

In 1963 a systematic study of the Myxomycetes of Costa Rica was begun by us, the second author being largely responsible for the collection of the specimens and the first largely responsible for their identification. Some specimens collected by Dr. George Carroll in 1962, by Dr. Bernard Lowy in 1964 and by Dr. E. F. Morris in 1966 are also included. A few of the specimens recorded were developed in moist chamber culture on tree bark, dead herbaceous stems, or other debris collected in Costa Rica by Dr. G. C. Carroll in 1964 and subsequently cultured at the University of Texas. The second author has continued collection, identification and moist chamber culture work and a second report will eventually be published elsewhere.

It will be noted that certain common species in such genera as Licea, Calomyxa, and Echinostelium, are absent from our list. These genera consist mainly of species with minute sporophores which are usually not detected in the field. Inasmuch as extensive moist chamber culture work was not undertaken in connection with this project such species were not observed. The classification adopted here is that of Alexopoulos (1973). Names of species are according to Martin and Alexopoulos (1969) and are arranged in alphabetical order under each genus. In the list of species reported below the collection locations are recorded with reference to the map (Figure 1) in which


NICARAGUA
II
ALAJUELA
IV
HEREDIA
V
GUANACASTE
OCEANO ATLANTICO
VI
LIMON
III
CARTAGO
SAN JOSE
I
OCEANO PACIFICO
PANAMA
VII
PUNTATENAS
28
30
29
31
15
19
27
24
26
14
13
12
25
37
32
16
18
17
3
1
4
6
2
10
9
5
22
20
7
21
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23
11
35
36
34
33

I. SAN JOSE
1. San Pédro, Sabanilla, Cinco Esquinas, San Ramon de Tres Rios
2. Los Juncales
3. Electriona
4. Rio Claro
5. Villa Colon
6. San Isidro de Coronado
7. Santa Maria de Dota
8. San Marcos de Tarrazu
9. Santa Ana
10. Aserri, Vuelta de Jorco
11. San Isidro del General

II. ALAJUELA
12. Lagunas de San Isidro
13. Carrizal
14. Tacares
15. Ciudad Quesada
16. San Matéo
17. Orotina
18. Atenas
19. Volcan Poas

III. CARTAGO
20. Orosi
21. El Empalme
22. Turialba
23. Cerro de la Muerte

IV. HEREDIA
24. La Virgen de Sarapiqui
25. Rio La Hoja
26. Vara Blanca
27. Puerto Viejo de Sarapiqui

V. GUANACASTE
28. El Coco
29. Canas
30. Liberia
31. Santa Cruz

VI. LIMON
32. Siquires
37. Guapiles

VII. PUNTARENAS
33. Coto 47
34. Golfito
35. Palmar Sur
36. San Vito de Java

Figure 1. Map of Costa Rica showing provinces (Roman numberals) and localities (Arabic numberals) where specimens were collected.

the provinces of Costa Rica are designated by Roman numerals and the localities by Arabic numerals in parenthesis. Thus, *Ceratiomyxa morchella* Welden, for example, is recorded from Sarapiqui of Heredia and from Siquirres of Limon, designated in this paper as IV (27) and VI (32) respectively.

Specimens are deposited in the myxomycete collection of the University of Costa Rica at San José under UCR numbers and in the University of Texas Myxomycete Collection (TEX) under UTMC numbers. Of a total of 91 species in this collection, 12 are listed by Welden from Costa Rica. Three of Welden's species, *Badhamia decipiens* (now *Physarum decipiens*), *Diderma chondrioderma*, and *Comatricha aequalis* are not included in our collection but are listed in this paper for the sake of completeness. This brings the total number of species now reported in the literature from Costa Rica to 94. In the list of species that follows, those preceded by an asterisk (*) have been reported from Costa Rica by Welden (1954). All others are new records for that country[2]. No attempt was made to search the world herbaria for Costa Rican myxomycete specimens. It is probable that a number of additional species could be recorded if that were to be done.

LIST OF SPECIES

Subclass CERATIOMYXOMYCETIDAE Martin
In Ainsworth, Dict. Fungi, ed 5, 497. 1961.

Order CERATIOMYXALES Martin, N. Am. Flora 1 (1):5. 1949.

Family CERATIOMYXACEAE Schroet., in Engler & Prantl, Nat. Pfl. 1 (1):15. 1889.

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[2] Most of the Costa Rica records in Martin and Alexopoulos (1969) refer to specimens in this collection.

Ceratiomyxa Schroet. in Engler & Prantl, Nat. Pfl. 1 (1): 16. 1889.

*1. *Ceratiomyxa fruticulosa* (Mull.) Macbr., N. Am. Slime-Moulds 18. 1899.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: Widespread and abundant. I (1), UCR-60 (TEX 418), 24 VI 1963; (7), UCR-127 (TEX 422), 9 VIII 1963; (8), UCR-259 (TEX 423), 5 XI 1964; (11), UCR-236 (TEX 424), 16 X 1964. III (21), UCR-66 (TEX 419), 28 VI 1963. IV (25), UCR-91 (TEX - specimen lost), 17 VII 1963. V (28), UCR-90 (TEX 420), UCR-95 (TEX 421), 19 VII 1963. VI, Welden, p. 96. All on dead wood.

COMMENTS: All specimens are typical of the species in the morphology of their fructifications and all but UCR-259 are of the arborescent type. In UCR-259 the fructification is sessile, the branches are very short, and the whole structure approaches the well-known *porioides* type. UCR-60, 90, and 259 are yellowish; all others are white. UCR-158 is an extensive group of robust, well-developed sporophores. The over-all range of spore dimensions is 6.5-7.5 μm. Many of the spores are oval to subglobose. In UCR-259 the spores are in the upper part of the over-all size range given above.

2. *Ceratiomyxa morchella* Welden Mycologia 46:94, 1954.

KNOWN WORLD DISTRIBUTION: Panama, Honduras (TEX), Surinam, Venezuela, Puerto Rico, Florida (TEX).

COSTA RICA: IV (27), UCR-153 (TEX 426), 24 XI 1963. VI (32) UCR-225 (TEX 427), 2 X 1964. Both on dead wood.

Most of the fructifications in UCR-153 are typically morchelloid. The spores are 6-7.5 x 7.5-10.5 μm. UCR-225, however, consists of one stipitate, morchelloid fructification, 3 sessile, circular somewhat flattened fruiting bodies, and one larger body 4.5 x 1 mm at its widest point which closely resembles the *porioides* form of *C. fruticulosa*. Furthermore, in spite of the fact that the range in spore size does not differ appreciably from what is expected, the majority of spores are in the upper limits of the range. It will be recalled that this was also the case with *C. fruticulosa* UCR-259 which approached the *porioides* form.

Specimens like UCR-225 cast some doubt on the validity of *C. morchella* as a good species, but until many more collections are available for extensive comparative studies, it is thought best to recognize the species. Contrary to *C. fruticulosa*, *C. morchella* and *C. sphaerosperma* have been found only in wet, hot lowlands (100-300 m).

*3. *Ceratiomyxa sphaerosperma* Boedjin, Misc. Zool. Sumatrana 24:1, 1927.

KNOWN WORLD DISTRIBUTION: Sumatra, Krakatoa, Panama Canal Zone, Dominica, Jamaica, Brazil, ?Spain.

COSTA RICA: IV (27), UCR-319 (TEX 1451), 10 VI 1966. On dead wood. VI, Castilla, C. W. Dodge 9238, 23 VII 1936.

The fructifications are typical of the species. The spores are spherical or subspherical, 6-7 μm diam.

Subclass MYXOGASTROMYCETIDAE Martin
In Ainsworth, Dict. Fungi, ed. 5. 497. 1961. Emend Ross,
Mycologia 65:483. 1973.

Order LICEALES Jahn, in Engler & Prantl, Nat. Pfl., ed. 2, 2:319. 1928.

Family RETICULARIACEAE Rost, Versuch 6. 1873 (as Tribus).

Tubifera J. F. Gmelin, Syst. Nat. 2:1472. 1791.

1. *Tubifera bombarda* (Berk. et Br.) Martin, Brittonia 13: 210. 1961.

KNOWN WORLD DISTRIBUTION: Ceylon, Malaya, Sumatra, Philippines (TEX 1682), Puerto Rico, Jamaica, Brazil.

COSTA RICA: I (1), UCR-126 (TEX 431), 7 VIII 1963. II (22) UCR-193 (TEX 438), leg.: B. Lowy, 25 VI 1964; (21) UCR-257 (TEX 437), 6 XI 1964. All on dead wood.

The sporangia of UCR-193 are typical and the pseudocapillitial bristles bear the spine-like protuberances; the spores measure 6-6.5 μm and their surfaces are definitely reticulate. UCR-126 and 257 represent an interesting variant. We place them here chiefly because of their long stipes on which the sporangia are borne. The fructifications, up to 5 mm tall, consist of from 7 to 20 sporangia, all on long stalks which are firmly united 2/3 to 3/4 of their length, but are separate at the top. The sporangia are ovate-cylindrical, with membranous peridia which are evanescent at the top. No pseudocapillitium is evident in any of the sporangia examined. Even those in which the peridium is still intact contain no bristles or other material except spores. Martin (1961) in reducing Alwisia to a synonym of Tubifera, noted that a Jamaican specimen at IF and IA lacks bristles. The spores of UCR-257 are definitely reticulate over most of the surface exhibiting a broken reticulation over about 1/4 of the wall. They measure 6.5-7 μm in UCR-126 and 6-6.75 μm in UCR-257. Dr. Martin, who kindly examined UCR-257, concurred with our determination.

2. Tubifera ferruginosa (Batsch) J. F. Gmel, Syst. Man. 2:1472. 1791.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (6), UCR-85 (TEX 429), 9 VII 1963. On dead wood. UCR-109 (TEX 436), 3 VIII 1963. III (21), UCR-63 (TEX 2256), 28 VI 1963. On mossy wood.

All three of these collections might represent sessile phases of T. microsperma except for the size of the spores. Each fructification consists of numerous, crowded, cylindrical sporangia tapering down to a stalk-like base. The fructification as a whole, however, unlike those in UCR-40, 43, and 78 (see next species below) in no case rests on a stalk-like hypothallus. The spores are strongly reticulate over at least one half and up to the entire surface and measure 6-6.5 μm being remarkably uniform in size. Such specimens are intermediate between T. ferruginosa and T. microsperma and throw doubt on the validity of the characters separating the two species.

3. Tubifera microsperma (Berk. & Curtis) Martin, Mycologia 39:461. 1947.

KNOWN WORLD DISTRIBUTION: North and South America, West Indies, Hawaii, Tropical Asia, Japan.

COSTA RICA: I (1), UCR-40 (TEX 430), 4 VI 1963, on dead wood; (5) UCR-78 (TEX 433), 3 VII 1963, on mossy dead wood. II (12), UCR-43 (TEX 434), 1 VI 1963, on dead wood.

If we are to recognize this species, these three collections fit perfectly in that all the fructifications have a conspicuous stalk-like hypothallus and the spores measure 5-6 µm diam.

Dictydiaethalium Rost., Versuch 5, 1873.

1. Dictydiaethalium plumbeum (Schum.) Rost., in Lister, Mycet. 157. 1894.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-59 (TEX 440), 23 VI 1963. IV (25), UCR-92 (TEX 432), 15 VII 1963. V (29), UCR-100 (TEX 439), 19 VII 1963. VII (35), UCR-308 (TEX 1450), 10 XI 1965. UCR-92 on bark; all others on dead wood.

All four collections are typical of the species, but UCR-59 is imperfectly matured. The pseudoaethalia of UCR-92 are dark chocolate-brown whereas in UCR-100 and 308 the color is more yellow-brown. The pseudocapillitial threads are 4-4.5 µm thick. The spores measure 9.5-10.5 µm diam. They are bright yellow in mass, pale yellow by transmitted light, with conspicuously thick, minutely roughened walls.

Lycogala Adans., Fam. Pl. 2:7. 1763.

1. Lycogala epidendrum (L.) Fries, Syst. Myc. 3:80. 1829.

KNOWN WORLD DISTRIBUTION: Cosmopolitan

COSTA RICA: Widespread and abundant. I (1), UCR-97 (TEX 443), 29 VII 1963; UCR-230 (TEX 445), 3 X 1964; (5), UCR-69 (TEX 441), UCR-70 (TEX 442), 3 VII 1963. III (20), UCR-8 (TEX 2255), 20 V 1963; (22), UCR-222 (TEX 444) 1 X 1964. VII (35); San Vito de Java, E. F. Morris #957 (TEX 1991), 13 III 1966. UCR-70 on bark; all others on dead wood.

COMMENTS: All 7 collections of this ubiquitous species are typical, with no more than expected variation in aethalial size, color, and markings. The spores in Nos. 8 and 230 measure 6-7.5 μm whereas those of the other specimens are smaller; 5.5-6.5 μm.

2. *Lycogala exiguum* Morgan, Jour. Cinc. Soc. Nat. Hist. 15:134. 1893.

KNOWN WORLD DISTRIBUTION: Cosmopolitan, especially in the tropics.

COSTA RICA: VII (35), UCR-311 (TEX-1444), 19 XI 1965.

COMMENTS: This species is usually easily identified by its dark, almost black aethalia and especially by the tesselate pustules on the peridium. The spores of the present specimen are somewhat on the large side, measuring 5.5-6.0+ μm. They are, however, warted rather than reticulate as in *L. epidendrum*. UCR-97 (see previous species) is close to *L. exiguum* because of its dark aethalia, its tesselate pustules and its non-reticulate spores. The latter, however, measure over 6 μm in diameter and on that basis we leave it in *L. epidendrum*. Such intermediate forms tend to confuse the issue and one is unable to draw a clear cut line between the two species.

Family CRIBRARIACEAE Rost. Versuch. 5. 1873.

Cribraria Pers., Neues Mag. Bot. 1:91. 1794.

The genus *Cribraria* is in great need of thorough revision. None of the existing keys is satisfactory and the characters of so many of the described species overlap that correct identification has become extremely difficult.

Unfortunately, no *Cribraria* has been grown in laboratory culture and it is impossible, therefore, to study the stability and consequently the validity of the characters used in separating species. In spite of this well-nigh chaotic situation, new species and even varieties continue to be described! The following identifications represent our best judgment, but in view of the above must be considered tentative.

1. *Cribraria intricata* Schrad., Nov. Grn. Pl. 7. 1797.

KNOWN WORLD DISTRIBUTION: Cosmopolitan

COSTA RICA: I (9), UCR-136 (TEX 2263), 20 IX 1963. II (15), UCR-201 (TEX 849), 24 IX 1964. IV (24), UCR-156 (TEX 2259), UCR-157 (TEX 843), 24 XI 1963; (27), UCR-322 (TEX 2262), 10 VI 1966. All on dead wood.

COMMENTS: Most specimens fit the description given by Martin & Alexopoulos (1969) as well as any *Cribraria* specimens fit any published description. The sporangia vary from .5 to .75 μm in diameter and the stalks from 1.5 to 2.5 mm in height. The cup is represented by a thin, membranous, small disc. The nodes are expanded with several free ends. UCR-156 approaches *C. splendens* because of the strong ribs, but the stalks are longer and the sporangia smaller than is generally true for that species.

2. *Cribraria languescens* Rex, Proc. Acad. Phila. 43:394. 1891.

KNOWN WORLD DISTRIBUTION: North America, West Indies, Europe, Asia, Africa.

COSTA RICA: I (2), UCR-110 (TEX 838), 3 VII 1963; (1) UCR-196 (TEX 2264), 11 IX 1964; (10) UCR-148 (TEX 840), 4 X 1963. IV (26), UCR-103 (TEX 837), 29 VII 1963. IV (25), UCR-266 (TEX 847), 17 IX 1965. VII (35), UCR-309 (TEX 789), 19 XI 1965. All on dead wood.

COMMENTS: There is considerable variation in these specimens. The diameter of the sporangia varies from .3 to .56 mm, and the stalks are much shorter in UCR-110, 148, and, to a lesser extent, in UCR-266, than usually described for this species. The color of the sporangia also deviates in many instances from the typical. Those of UCR-266, for example, are very dark. Until we have a better understanding of this genus, all these specimens must be placed in *C. languescens*.

3. *Cribraria microcarpa* Schrad., Nov. Gen. Pl. 8. 1797.

KNOWN WORLD DISTRIBUTION: Europe, N. America, West Indies, Colombia, Brazil.

COSTA RICA: I (4), UCR-56 (TEX 841), 21 V 1963. II (14), UCR-131 (TEX 851), 17 VIII 1963. Both on dead wood.

COMMENTS: UCR-56 is a rather typical specimen. UCR-131, on the other hand, exhibits great variation in sporangial diameter and in sporangium:stalk relationship. At first glance the specimen appears to be a mixture of two species, but we believe it is all *C. microcarpa*.

4. *Cribraria minutissima* Schw., Trans. Am. Phil. Soc. II, 4:260. 1832.

KNOWN WORLD DISTRIBUTION: U.S.A., West Indies, Uruguay, Brazil, Europe, Hawaii, Asia.

COSTA RICA: V (31), UCR-91 (TEX 852), 18 VI 1964. On dead wood.

COMMENTS: Whether this specimen is indeed *C. minutissima* or whether it represents an undescribed species is difficult to determine because of the very small number of sporangia at hand, none of which is intact. The overall height of the sporangia does not exceed .37 mm high and the sporangium about .13-.14 µm diam. The cup is represented by a minute membranous disc. The peridial net consists of even threads connected by small, flat, scarcely expanded nodes, and forming mostly pentagonal regular meshes. There are no free ends. The spores measure 6 µm.

5. *Cribraria splendens* (Schrad.) Pers., Syn. Fung. 191. 1801.

KNOWN WORLD DISTRIBUTION: Europe, N. America, West Indies, Brazil, Asia.

COSTA RICA: I (2), UCR-111 (TEX 790), 3 VII 1963; (7), UCR-122 (TEX 848), 9 VIII 1963; (8) UCR-258 (TEX 2261), 5 XI 1964. IV (24), UCR-155 (TEX 853), 24 XI 1963. All on dead wood.

COMMENTS: All these are probably *C. splendens*, but in UCR-111 the sporangia are smaller than usual and the nodes are somewhat thickened. UCR-155 is the specimen most typical of the species.

6. *Cribraria tenella* Schrad., Nov. Gen. Pl. 6. 1797.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-207 (TEX 844), 28 X 1964, UCR-247 (TEX 845), 26 X 1964, UCR-99 (TEX 791), 27 VII 1963; UCR-46b (TEX 2265), 8 VI 1963. III (22), UCR-221 (TEX 846), 1 X 1964. II (14), UCR-132 (TEX 850) 17 VIII 1963. All on dead wood.

COMMENTS: Of the six, UCR-99 is probably the most typical but all deviate in some character from the description. UCR-207 approaches *C. languescens*. In UCR-132 there are a number of free ends in the peridial net.

7. *Cribraria violacea* Rex, Proc. Acad. Sci. Phila, 43:393. 1891.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-1145, 16 IV 1971, on dead wood. Locality unknown, TEX-842, summer 1964, leg. G. C. Carroll, on bark. Both developed in moist chamber.

COMMENTS: The color and the minuteness of the sporophores make this species unmistakable.

Dictydium Schrad., Nov. Gen. Pl., 11. 1797.

*1. *Dictydium cancellatum* (Batsch) Macbride

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: Widely distributed and abundant. I (1), UCR-68 (TEX 824), 2 VII 1963; UCR-48 (TEX 825), 8 VI 1963; (6), UCR-86 (TEX 826), 9 VII 1963. III, (20), Welden, p. 96, UCR-19 (TEX 822), 20 V 1963. II (12), UCR-33 (TEX 823), 1 VI 1963. IV (24), UCR-152 (TEX 827), 24 XI 1963. All on dead wood.

COMMENTS: All specimens are typical and remarkably uniform with only very minor variations. In UCR-33 the sporangia are a trifle smaller and the spores somewhat larger than in the other specimens.

Order ECHINOSTELIALES Martin, Mycologia 52:127. 1960.

Family CLASTODERMATACEAE Alexopoulos & Brooks, Mycologia 63:926. 1971.

Clastoderma Blytt, Bot. Zeit. 38:343. 1880.

1. Clastoderma debaryanum Blytt, Bot. Zeit. 38:343. 1880.

KNOWN WORLD DISTRIBUTION: Probably cosmopolitan, abundant in the tropics.

COSTA RICA: I (1), UCR-195 (TEX 2254), 11 IX 1964, on bark covered with lava dust. Locality not recorded, UCR-105 (TEX 2173), July 1963, developed in moist chamber on bark from unidentified tree, collected July 1963 and cultured in Austin, Texas. Sporangia formed on filter paper in August 1964 and September 1965.

COMMENTS: Our specimens represent an interesting but not very rare variation from the typical in that the prominent, oval, amber-like swelling which usually divides the two portions of the stipe, is absent from all our sporangia.

Order TRICHIALES Macbride, N. Am. Slime-Moulds, ed. 2. 237. 1922.

Family TRICHIACEAE Rost., Versuch 14. 1873 (as tribus).

Perichaena Fries, Symb. Gast. 11. 1817.

1. Perichaena chrysosperma (Currey) Lister

KNOWN WORLD DISTRIBUTION: Cosmopolitan

COSTA RICA: II (13), UCR-104 (TEX 830), 30 VII 1963.

COMMENTS: This specimen consists of several typical sporangia and plasmodiocarps on bark. Most plasmodiocarps are doughnut-shaped.

2. Perichaena depressa Lib., Pl. Crypt. 378. 1837.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: Locality unknown, G. C. Carroll #3, (TEX 1452), summer 1964. On plant debris in moist chamber.

COMMENTS: This is a typical specimen.

Arcyria Wiggers, Prim. Fl. Holsat. 109. 1780.

*1. Arcyria cinerea (Bull.) Pers. Syn. Fung. 184. 1801.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: Widely distributed and abundant. I (1) UCR-41 (TEX 807), 4 VI 1963, UCR-113 (TEX 809), 5 VII 1963. II (12), UCR-32 (TEX 810), 1 VI 1963; (14), UCR-129 (TEX 805), UCR-133 (TEX 803), 17 VIII 1963; (15), UCR-197 (TEX 804), 24 IX 1964. V (28), UCR-93 (TEX 808), 19 VII 1963; (31), UCR-192 (TEX 812), 20 VI 1964. VII (34), Welden, p. 96, UCR-303 (TEX 811), UCR-315 (TEX 806), 16 XI 1965. IV (27), TEX 859, G. C. Carroll # CR-2, 11 VI 1962, UCR-326, 10 VI 1966.

COMMENTS: This is an extremely variable species. In color, the sporangia range from ashy gray, almost white, to a decidedly yellowish hue; in shape, from ovate to long cylindrical when mature. The capillitium is usually distinctly spiny. The so-called digitate form was described by Schweinitz in 1832 as a distinct species, A. digitata, but all modern authors agree it is only a variation of A. cinerea particularly common in the tropics. Inasmuch as, in many fruitings, single sporangia are usually mixed with those united on a common stalk, it appears that a single plasmodium may give rise to both forms. It is of interest to note, however, that we have never been able to germinate spores from digitate fruitings whereas we have often obtained cultures by sowing spores from single sporangia on agar. Nevertheless, Mims (personal communication) noted the formation of some digitate fruitings in agar cultures obtained by sowing spores from single sporangia collected by one of us (C.J.A.) in Hawaii. Thus, we have experimental as well as circumstantial evidence that the two forms (single and digitate) are the same species.

From the specimens at hand, UCR-32, 93, 113, 197, and 303 are cinereous, whereas UCR-41, 129, 133, 192, and 315 show various amounts of a creamy or yellowish color. In all but UCR-315 the sporangia are cylindrical; in UCR-315 they are mostly globose to ovate. They vary in length from .25 mm to 1.5 mm in UCR-315 to as long as 3 mm in UCR-303. These measurements do not include the stalk. UCR-133 and 303 are typically digitate forms with few if any single sporangia present. Most of the other collections are mixed digitate and simplex with only UCR-315 consisting of only single sporangia. This is in accordance with the well known observation that the digitate form is more prevalent in the tropics.

*2. Arcyria denudata (L.) Wettst. Verh. Zool.-Bot. Ges. Wien 35:abh. 535. 1886.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: Widespread and common. I, Welden, p. 97, (1), UCR-21 (TEX 817), 21 V 1963, UCR-27 (TEX 814), 21 V 1963; (5), UCR-72 (TEX 813), UCR-79 (TEX 815), 3 VII 1963; (6), TEX 858, collected by G. C. Carroll # GC-1 12 VI 1962. II (12), UCR-34 (TEX 816), 1 VI 1963; (14), UCR-130 (TEX 818), 17 VIII 1963. III (20), UCR-7 (TEX 820), 20 V 1963. IV (27), UCR-321 (TEX 1449), 10 VI 1966. V (30), UCR-101 (TEX 821), 19 VII 1963. VI, Welden, p. 97. VII (34), E. F. Morris #970 (TEX 1996), 16 III 1966.

COMMENTS: The color of the sporangia in the various collections varies from bright rose in UCR-79 to a light chocolate brown in UCR-72. UCR-79 approaches Hagelsteins' (1929) variety dispersa of A. insignis. The sporangia are bright rose, somewhat smaller than in typical A. denudata and scattered. Nevertheless, we believe that the specimen is better referred to A. denudata. UCR-72 on mossy wood; UCR-7, 21, 27, 34, and 79 on dead wood; UCR-101, 130 and GC #1 on bark.

3. Arcyria incarnata Pers., Obs. Myc. 1:58, 1796.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-178 (TEX 829), 5 VI 1964. V (31), UCR-184 (TEX 828), 20 VI 1964.

COMMENTS: This is much less common than the previous species. Both specimens are typical. UCR-178 on bark, UCR-184 on dead wood.

4. *Arcyria insignis* Kalch. & Cooke, in Kalchbr., Grevilia 10:143. 1882.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-25 (TEX 857), 22 V 1963. III (22), UCR-219 (TEX 856), 1 X 1964. Both on dead wood.

COMMENTS: The chief differences between this species and *A. denudata* are color and size of sporangia and size of sporangial groupings. Except in relatively rare instances the two species may be distinguished easily. Both our specimens are typical of *A. insignis*. Reference has already been made to UCR-79 which we placed in *A. denudata*. This represents a form intermediate between the two species.

5. *Arcyria leiocarpa* (Cooke) Martin & Alexop. The Myxomycetes 131. 1969.

KNOWN WORLD DISTRIBUTION: U.S.A., Panama, Colombia, Scotland, Czechoslovakia.

COSTA RICA: II (Finca los Ensaynos de Buena Vista), summer 1964. In moist chamber culture on debris collected by George Carroll.

COMMENTS: Only three sporangia developed in the culture but were typical of this species. Unfortunately, the specimen was overrun with mold and was discarded. There is, therefore, no voucher available.

6. *Arcyria magna* Rex, Proc. Acad. Phila. 45:364. 1893.

KNOWN WORLD DISTRIBUTION: N. America, Panama, Brazil, Philippines, Thailand.

COSTA RICA: V (31), UCR-187 (TEX 1440), 18 VI 1964.

COMMENTS: The specimen is not typical of the species chiefly because of the small cluster of the sporangia. The fruiting mass is dingy yellow to olivaceous but the spores are dull rose in mass. The capillitium bears cogs, half-rings and spines. Although its distribution is wide in the Western Hemisphere, _A. magna_ is not commonly found. Dr. Marie L. Farr concurs with our identification.

Hemitrichia Rost., Versuch. 14. 1873.

*1. _Hemitrichia calyculata_ (Speg.) Farr, Mycologia 66:887. 1974.

This species is usually reported as _H. stipitata_ (Massee) Macbr. It is under this name that our specimens are filed.

KNOWN WORLD DISTRIBUTION: Cosmopolitan and common. Abundant in the tropics.

COSTA RICA: I, Welden, p. 97; (1), UCR-53 (TEX 1361), 8 VI 1963, UCR-57 (TEX 1358), 24 VI 1963, UCR-204 (TEX 1363), 28 IX 1964; (5), UCR-75 (TEX 1360), UCR-76 (TEX 1359), 3 VII 1963. II (12), UCR-31 (TEX 1426), 1 VI 1963; (15) UCR-203 (TEX 1429), 24 IX 1964. III, Welden, p. 97; (20), UCR-9 (TEX 1423), UCR-10 (TEX 1424), UCR-17 (TEX 1425), 20 V 1963; (22), UCR-231 (TEX 1430), 1 X 1964, E. F. Morris #901 (TEX 1995), 18 II 1966. IV, Welden, p. 97; (24), UCR-160 (TEX 1362), 24 XI 1963. VI, Welden, p. 97. VII, Welden, p. 97; (34), UCR-314b (TEX 1432), 16 XI 1965. All on decaying wood.

COMMENTS: In its typical expression, _H. calyculata_ exhibits a slender, dark brown, almost black, stalk which may reach a length of 2 mm, as in UCR-231, and which terminates abruptly at the base of a shallow cup with sides at an obtuse angle. The capillitial threads are essentially smooth and the spores are bright yellow, unevenly spinulose, and 7.5-9 μm diam. However, most of these characters vary considerably even in the same collection and this variation has caused Lister (1894, 1911, 1925) and Hagelstein (1944) to consider this species synonymous with _H. clavata_ which it admittedly resembles. Unpublished electron micrographs, however, bring out some interesting differences in the capillitia of the two species which appear to be, for the most part, constant. Lister and Hagelstein (loc. cit.) believe *H. calyculata* to be an environmentally induced variant of *H. clavata*, developed under conditions of high temperature. It is of interest in this connection that *H. calyculata* is abundant in the tropics as well as in the temperate zones whereas *H. clavata* is found only in the temperate zones (Martin & Alexop., 1969).

Until experimental cultural studies are conducted to determine the effect of the environment at the time of sporulation on the taxonomic characters of the Myxomycetes, these questions will not receive a definitive answer. Unfortunately, neither *H. calyculata* nor *H. clavata* has been grown in laboratory culture.

In the specimens at hand, the stalks vary from light yellow-brown to almost black and from .45 mm or shorter to 2 mm. They terminate abruptly at the base of a more or less shallow cup in most specimens, but some sporangia in UCR-9, 31, 53, and 203 have short stalks which merge with the bases of the rather deep cups approaching the situation in *H. clavata*. The capillitium is nearly smooth in most specimens but distinctly roughened in UCR-9, 31, and 203. In spite of these variations, it seems best to include all specimens in *H. calyculata*.

2. *Hemitrichia serpula* (Scop.) Rost. in Lister Mycet. 179. 1894.

KNOWN WORLD DISTRIBUTION: Cosmopolitan; abundant in the tropics.

COSTA RICA: III (20), UCR-20(TEX 1418), 20 V 1963; IV (26), UCR-102 (TEX 1418), 29 VII 1963; El Roble, UCR-108 (TEX 1420), 30 VII 1963. V, near Laguna de Arenal, E. F. Morris #982 (TEX 1998), 22 III 1966. VII (34), UCR-314a (TEX 1431), 16 XI 1965. UCR-20 and 108 on plant debris; UCR-314a and Morris 982 on decaying wood; UCR-102 on bark.

COMMENTS: This easily recognized species is widely distributed and quite constant in its characters. All specimens in our collection are typical except for the diameter of the capillitial threads which tends to be greater than that given in the various monographs, reaching, in most of our specimens 7.5 µm. This and other species of Myxomycetes are often parasitized by a fungus (Stilbella sp.) which produces its synnemata on the surface of the fructifications as in our UCR-108.

Metatrichia Ing, Trans. Brit. Mycol. Soc. 47:51. 1964.

1. Metatrichia vesparium (Batsch) Nann.-Brem. K. Ned. Akad. Wet. C. 69:146. 1966.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-227 (TEX 1366), 9 X 1964; (3), UCR-44 (TEX 1364), 8 VI 1963; (9), UcR-268 (TEX 1367), 27 V 1965. II (22), UCR-214 (TEX 1365), 1 X 1964. VII (33), UCR-290 (TEX 1368), 17 XI 1965. All on decaying wood.

COMMENTS: This very common and easily recognized species usually occurs in two forms: 1) as short-stalked or sessile sporangia crowded into large clusters (pseudoaethalia), as in UCR-44 and 268, and 2) as polycephaloid, long-stalked pseudoaethalia in which the stalks of many sporangia are completely fused as in UCR-214, 227, and 290. One would be tempted to recognize these two forms as distinct varieties were it not for their occurrence side by side in some fruitings and together with a few individual sporangia. UCR-290 is not mature.

Trichia Haller, Hist. Stirp. Helv. 3:114. 1768.

1. Trichia decipiens (Pers.) Macbr., N. Am. Slime Moulds 218. 1899.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I, (Finca La Azucena, Carretera Panamaericana), UCR-297 (TEX 1407), 19 XI 1965. On decaying wood.

COMMENTS: The single specimen in our collection is typical of the species.

2. Trichia favoginea (Batsch) Pers., Neues Mag. Bot. 1:90. 1794.

KNOWN WORLD DISTRIBUTION: Throughout the temperate zone but also known from the tropics.

COSTA RICA: I (8), UCR-254 (TEX 1409), 5 XI 1964, on bark. III (23), UCR-241 (TEX 1408), 17 X 1964, on bark among Bryophytes.

COMMENTS: Although most spores observed exhibit a rather typical complete reticulation, in some spores of both specimens the reticulation is broken or incomplete. It is chiefly on the nature of the reticulation that *T. favoginea* was formerly separated from *T. persimilis* until Farr's (1958) study pointed out the great variability of this character and placed *T. persimilis* and *T. affinis* in synonymy with *T. favoginea*. It is possible, of course, that such variation may represent genetic segregation of possible hybrids between two extreme forms, but until experimental evidence to the contrary becomes available, we are accepting Farr's conclusions.

3. *Trichia floriformis* (Schw.) G. Lister, Jour. Bot. 57: 110. 1919.

KNOWN WORLD DISTRIBUTION: Widely distributed in all continents but Africa from where it has not yet been reported. In the Caribbean area, known only from Puerto Rico and Jamaica.

COSTA RICA: I (7), UCR-119 (TEX 1911), 9 VIII 1963. IV (25) UCR-96 (TEX 1410), 27 VII 1963. Both on bark.

COMMENTS: *Trichia floriformis* may be recognized by the petaloid dehiscence of the sporangia, the deep red color of the stalks and the capillitium, and the reddish spores. In a general way it resembles *T. botrytis* to which it is probably most closely related. The latter has not as yet been found in Costa Rica and, indeed, appears to be rare in the tropics. The *T. floriformis* sporangia of our specimens are black, which is often the case.

4. *Trichia scabra* Rost., Mon. 258. 1875.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (7), UCR-118 (TEX 1413), 9 VIII 1963. IV (25), UCR-143 (TEX 1414), 9 XI 1963, both on dead wood.

COMMENTS: All spores examined bear a definite reticulation, at least on one hemisphere and often over the entire surface. Some spores appear oval or slightly turbinate and measure 10 x 12.5 μm.

5. *Trichia varia* (Pers.) Pers., Neues Mag. Bot. 1:90. 1794.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (11), UCR-234 (TEX 1415), 16 X 1964. IV (25), UCR-167 (TEX 1412), 9 IV 1964, on stroma of ascomycete.

COMMENTS: Both are typical specimens, although some elaters appear to have three rather than two spiral bands. UCR-167 was determined by Dr. Marie L. Farr.

6. *Trichia verrucosa* Berk., in Hook, f. Tasm. 2:269. 1859.

KNOWN WORLD DISTRIBUTION: Tasmania, New South Wales, Europe, U.S.A., Mexico, Dominica, Jamaica, South America.

COSTA RICA: I (8), UCR-253b (TEX 1417), 5 XI 1964, on bark.

COMMENTS: Although widely distributed this species is not so common as some of the other Trichias. Our collection consists of three clusters of sporangia interspersed among many fine sporangia of *Physarum tenerum* (UCR-252a). The material is in all ways typical.

Order PHYSARALES Macbride, N. Am. Slime-Moulds ed. 2. 22. 1922.

Family PHYSARACEAE Rost., Versuch. 9. 1873 (as tribus).

Cienkowskia Rost., Versuch. 9, 1873.

1. *Cienkowskia reticulata* (Alb. & Schw.) Rost. Mon. 91. 1874.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: III (21), UCR-62 (TEX 1447), 28 VI 1963, on dead wood.

COMMENTS: A collection of many sporophores ranging from .5 mm spheres to 6 mm long, straight or sinuous plasmodiocarps. The peridium is covered with a thick incrustation of yellow lime on which tomato-red glossy spots are scattered. The duplex nature of the capillitium is evident but the spiny branches of the tubules are not so numerous as they are usually.

Physarella Peck, Bull. Torrey Bot. Club 9:61. 1882.

1. *Physarella oblonga* (Berk. & Curtis) Morgan Jour. Cinc. Soc. Nat. Hist. 19:7. 1896.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-28 (TEX 1437), UCR-38 (TEX 1438), 28 V 1963, UCR-50 (TEX 1439), 8 VI 1963. All on dead wood.

COMMENTS: Of our three specimens only UCR-50 is in good condition, the other two having fruited on decaying wood encrusted with lava dust which crumbles and results in the destruction of most sporangia thereon.

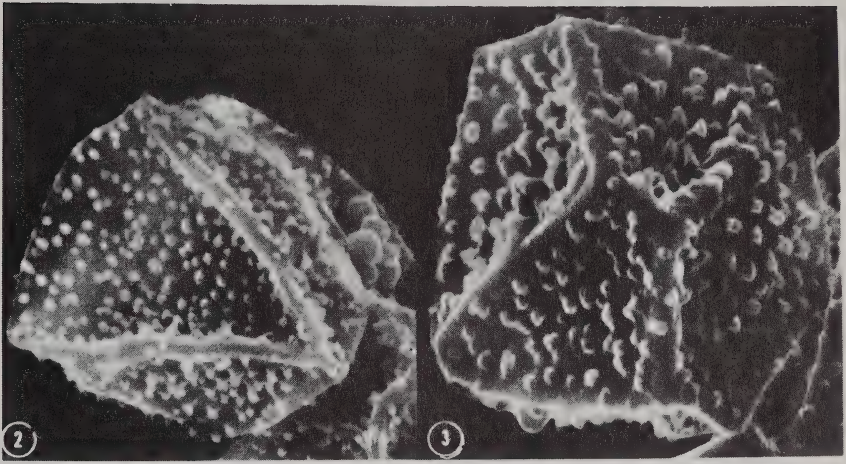
Badhamia Berk., Trans. Linn. Soc. 21:153. 1853.

1. *Badhamia cinerascens* Martin, Jour. Wash. Acad. 22:88. 1932.

KNOWN WORLD DISTRIBUTION: Colombia.

COSTA RICA: III, UCR-13 (TEX 2105), 11 V 1965. On bark. (Authentic specimen).

COMMENTS: This is the second world collection of this species reported in the literature and is the only specimen of a *Badhamia* from Costa Rica in our collection. Dr. G. W. Martin, who first described this species, concurred with our identification, noting, however, that ". . . the Costa Rican collection is more limy than the type and the spores somewhat smaller, but I can regard neither character as significant . . . Certainly I cannot assign your specimen to anything but B. cinerascens." Figures 2 and 3 are presented as further evidence in support of our identification.



Figures 2-3. Scanning electron micrographs of the spores of Badhamia cinerascens Martin.
Figure 2. Spore of UCR-13, X 4500
Figure 3. Spore from TYPE in IA, X 5070
(Magnifications approximate).

Fuligo Hall., Hist. Stirp. Helv. 3:110. 1768.

1. Fuligo megaspora Sturgis, Colo. Coll. Publ. Sci. 12:443. 1913.

KNOWN WORLD DISTRIBUTION: U.S.A., Guatemala, Europe, Congo, Pakistan.

COSTA RICA: IV (25), UCR-168 (TEX 1448), 9 IV 1964. On dead wood.

COMMENTS: A typical well-formed aethalium, 3 cm in length. Most spores measure 18 μm diam.

*2. Fuligo septica (L.) Wiggers, Prim. Fl. Holsat. 112. 1780.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: Widely distributed and very common. I (5), UCR-81 (TEX 1435), UCR-82 (TEX 1454), UCR-87 (TEX 1456), 8 VII 1963. II (19), UCR-83 (TEX 1455), 7 VII 1963. III, UCR-80 (TEX 1434), 4 VII 1963; IV, Welden, p. 97. V (31), UCR-182 (TEX 1436), 19 VI 1964, UCR-185 (TEX 1457), 20 VI 1964. VII, Welden, p. 97. (34), UCR-318 (TEX 1458), 16 XI 1965. All on wood or bark.

COMMENTS: In UCR-182 the lime of the cortex is white; in all others it is some shade of yellow. Differences in color of the cortex have been used to distinguish among varieties (Martin & Alexopoulos, 1969; Nannenga-Bremekamp, 1973) but the taxonomic significance of aethalial color can be determined only by careful culture work and genetic studies under controlled conditions. *F. septica* is relatively easy to grow in laboratory culture from spores to the plasmodial stage, but cultures sporulate unpredictably and only after a very long time.

Craterium Trent., in Roth, Catalecta Bot. 1:224. 1797.

1. *Craterium leucocephalum* (Pers.) Ditmar, in Sturm, Deuts. Fl. Pilze 1:21. 1813.

KNOWN WORLD DISTRIBUTION: Cosmopolitan

COSTA RICA: I (1), UCR-171 (TEX 1459), 3 VI 1964; (7) UCR-243 (TEX 1461), 6 XI 1964. II (16), UCR-279 (TEX 1462), 7 VI 1965. V (31), UCR-190 (TEX 1460), 18 VI 1964. VII (34), UCR-301 (TEX 1463), 16 IX 1965; (35), UCR-306 (TEX 1464), 19 XI 1965. UCR-171 on bark; UCR-243, 279, 190, on dead leaves; UCR-301 on living leaves; UCR-306 on dead wood.

COMMENTS: Considerable variation is encountered in this species in the shape and color of the sporangia and their method of dehiscence. In UCR-171, 190, and 279 the sporangia are essentially globose; in UCR-243 they are long goblet-shape; and in UCR-306 they are intermediate. In UCR-243 and 279 the brown base of the sporangium is clearly evident; in the others the sporangia are almost entirely white. The operculum is perfectly developed in UCR-243; in all others dehiscence is irregular. Whether the variations noted are genetically or environmentally controlled is not known.

Physarum Pers., Neues Mag. Bot. 1:88. 1794.

1. Physarum bitectum G. Lister, Mycet. ed. 2. 78. 1911.

KNOWN WORLD DISTRIBUTION: Western Europe, U.S.A., Puerto Rico, Colombia, South Africa, Australia, New Zealand.

COSTA RICA: I (10), UCR-287 (TEX 2113), 15 VII 1965, on dead leaf.

COMMENTS: This species is not commonly reported, but as Martin & Alexopoulos (1969) mention, it may be more widespread than is supposed because it often resembles other species such as P. bivalve and may be misdetermined. Our specimen appears to be typical. Dr. Marie L. Farr concurs with our identification.

2. Physarum bivalve Pers., Ann. Bot. Usteri 15:5. 1795.

KNOWN WORLD DISTRIBUTION: Europe, N. America, Chile, South Africa, Angola, Southeast Asia, Japan, Philippines, Samoa.

COSTA RICA: I (7), UCR-121 (TEX 1465), 9 VIII 1963, on dead wood, UCR-251 (TEX 1467), 6 XI 1964, on dead leaves. V (31), UCR-183 (TEX 1466), 20 VI 1964, on dead leaves.

COMMENTS: UCR-251 is the most typical of the three specimens, consisting both of isolated sporangia and variously shaped plasmodiocarps of different lengths. The most interesting of the three specimens, however, is UCR-183 in which all the sporophores are in the form of bright yellow, clam-shaped sporangia.

3. Physarum bogoriense Racib., Hedwigia 37:52. 18F. 1898.

KNOWN WORLD DISTRIBUTION: Known from all continents but particularly abundant in the tropics and subtropics.

COSTA RICA: I (1), UCR-205 (TEX 1471), 28 IX 1964, on herbaceous stem, UCR-98 (TEX 1469), 29 VII 1963, on mossy bark, UCR-147 (TEX 1470), 18 X 1963, on dead leaf. II (17), Orotima, UCR-281 (TEX 1473), 9 VI 1965, on dead leaf. III (22), UCR-220 (TEX 1472), 1 X 1964, on plant debris. IV, UCR-64 (TEX 1468), 24 VI 1963, on leaf base.

COMMENTS: This distinctive species fruits occasionally on bark or wood but usually on dead leaves and plant debris.

The yellowish or brown outer peridium and the stellate dehiscence make it easy to recognize in the field under a hand lens. Only occasionally encountered in cold climates, it is one of the most abundant species in warm regions.

4. Physarum cinereum (Batsch) Pers., Neues Mag. Bot. 1:89. 1794.

KNOWN WORLD DISTRIBUTION: Cosmopolitan and very common.

COSTA RICA: I (1), UCR-172 (TEX 2233), 3 VI 1964; (7), UCR-244 (TEX 1475), 6 XI 1964, both on living leaves, San Antonio de Belem, UCR-329 (TEX 1487), 3 VII 1966, on dead wood.

COMMENTS: In UCR-244 the sporangia are well formed but the lime is scanty and the peridium is iridescent; the spores measure 7-9 µm. In UCR-239 the lime is much more abundant and there are two long, branched plasmodiocarps in addition to the few sporangia. One is tempted to place this specimen in the closely allied P. vernum, but the spores are clearly brownish-violaceous rather than dark purplish-brown; it seems better, therefore, to retain it in P. cinereum in spite of its occurrence on wood. UCR-172 is a scanty collection of but a few sporangia. The spores are not well formed and the determination is therefore tentative.

5. Physarum citrinum Schum., Enum. Pl. Saell. 2:201. 1803.

KNOWN WORLD DISTRIBUTION: Cosmopolitan but not common.

COSTA RICA: I (11), UCR-240 (TEX 1474), 16 X 1964, on wood.

COMMENTS: Our specimen, consisting of over 100 sporangia, is typical in some respects, not so in others. The sporangia are .7-1 mm diam.; the stalks are short and calcareous but tend to be more orange than yellow in color; the columella is minute and conical but the capillitial nodes are elongated. The spores are almost smooth and measure 11-12 µm, which is somewhat larger than described. New species have been described on smaller differences!

6. Physarum compressum Alb. & Schw., Consp. Fung. 97. 1805.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

our specimens 7.5 µm. This and other species of Myxomycetes are often parasitized by a fungus (Stilbella sp.) which produces its synnemata on the surface of the fructifications as in our UCR-108.

Metatrichia Ing, Trans. Brit. Mycol. Soc. 47:51. 1964.

1. Metatrichia vesparium (Batsch) Nann.-Brem. K. Ned. Akad. Wet. C. 69:146. 1966.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-227 (TEX 1366), 9 X 1964; (3), UCR-44 (TEX 1364), 8 VI 1963; (9), UcR-268 (TEX 1367), 27 V 1965. II (22), UCR-214 (TEX 1365), 1 X 1964. VII (33), UCR-290 (TEX 1368), 17 XI 1965. All on decaying wood.

COMMENTS: This very common and easily recognized species usually occurs in two forms: 1) as short-stalked or sessile sporangia crowded into large clusters (pseudoaethalia), as in UCR-44 and 268, and 2) as polycephaloid, long-stalked pseudoaethalia in which the stalks of many sporangia are completely fused as in UCR-214, 227, and 290. One would be tempted to recognize these two forms as distinct varieties were it not for their occurrence side by side in some fruitings and together with a few individual sporangia. UCR-290 is not mature.

Trichia Haller, Hist. Stirp. Helv. 3:114. 1768.

1. Trichia decipiens (Pers.) Macbr., N. Am. Slime Moulds 218. 1899.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I, (Finca La Azucena, Carretera Panamaericana), UCR-297 (TEX 1407), 19 XI 1965. On decaying wood.

COMMENTS: The single specimen in our collection is typical of the species.

2. Trichia favoginea (Batsch) Pers., Neues Mag. Bot. 1:90. 1794.

KNOWN WORLD DISTRIBUTION: Throughout the temperate zone but also known from the tropics.

COSTA RICA: I (8), UCR-254 (TEX 1409), 5 XI 1964, on bark. III (23), UCR-241 (TEX 1408), 17 X 1964, on bark among Bryophytes.

COMMENTS: Although most spores observed exhibit a rather typical complete reticulation, in some spores of both specimens the reticulation is broken or incomplete. It is chiefly on the nature of the reticulation that _T. favoginea_ was formerly separated from _T. persimilis_ until Farr's (1958) study pointed out the great variability of this character and placed _T. persimilis_ and _T. affinis_ in synonymy with _T. favoginea_. It is possible, of course, that such variation may represent genetic segregation of possible hybrids between two extreme forms, but until experimental evidence to the contrary becomes available, we are accepting Farr's conclusions.

3. _Trichia floriformis_ (Schw.) G. Lister, Jour. Bot. 57: 110. 1919.

KNOWN WORLD DISTRIBUTION: Widely distributed in all continents but Africa from where it has not yet been reported. In the Caribbean area, known only from Puerto Rico and Jamaica.

COSTA RICA: I (7), UCR-119 (TEX 1911), 9 VIII 1963. IV (25) UCR-96 (TEX 1410), 27 VII 1963. Both on bark.

COMMENTS: _Trichia floriformis_ may be recognized by the petaloid dehiscence of the sporangia, the deep red color of the stalks and the capillitium, and the reddish spores. In a general way it resembles _T. botrytis_ to which it is probably most closely related. The latter has not as yet been found in Costa Rica and, indeed, appears to be rare in the tropics. The _T. floriformis_ sporangia of our specimens are black, which is often the case.

4. _Trichia scabra_ Rost., Mon. 258. 1875.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (7), UCR-118 (TEX 1413), 9 VIII 1963. IV (25), UCR-143 (TEX 1414), 9 XI 1963, both on dead wood.

COMMENTS: All spores examined bear a definite reticulation, at least on one hemisphere and often over the entire surface. Some spores appear oval or slightly turbinate and measure 10 x 12.5 µm.

5. Trichia varia (Pers.) Pers., Neues Mag. Bot. 1:90. 1794.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (11), UCR-234 (TEX 1415), 16 X 1964. IV (25), UCR-167 (TEX 1412), 9 IV 1964, on stroma of ascomycete.

COMMENTS: Both are typical specimens, although some elaters appear to have three rather than two spiral bands. UCR-167 was determined by Dr. Marie L. Farr.

6. Trichia verrucosa Berk., in Hook, f. Tasm. 2:269. 1859.

KNOWN WORLD DISTRIBUTION: Tasmania, New South Wales, Europe, U.S.A., Mexico, Dominica, Jamaica, South America.

COSTA RICA: I (8), UCR-253b (TEX 1417), 5 XI 1964, on bark.

COMMENTS: Although widely distributed this species is not so common as some of the other Trichias. Our collection consists of three clusters of sporangia interspersed among many fine sporangia of Physarum tenerum (UCR-252a). The material is in all ways typical.

Order PHYSARALES Macbride, N. Am. Slime-Moulds ed. 2. 22. 1922.

Family PHYSARACEAE Rost., Versuch. 9. 1873 (as tribus).

Cienkowskia Rost., Versuch. 9, 1873.

1. Cienkowskia reticulata (Alb. & Schw.) Rost. Mon. 91. 1874.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: III (21), UCR-62 (TEX 1447), 28 VI 1963, on dead wood.

COMMENTS: A collection of many sporophores ranging from .5 mm spheres to 6 mm long, straight or sinuous plasmodiocarps. The peridium is covered with a thick incrustation of yellow lime on which tomato-red glossy spots are scattered. The duplex nature of the capillitium is evident but the spiny branches of the tubules are not so numerous as they are usually.

Physarella Peck, Bull. Torrey Bot. Club 9:61. 1882.

1. Physarella oblonga (Berk. & Curtis) Morgan Jour. Cinc. Soc. Nat. Hist. 19:7. 1896.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-28 (TEX 1437), UCR-38 (TEX 1438), 28 V 1963, UCR-50 (TEX 1439), 8 VI 1963. All on dead wood.

COMMENTS: Of our three specimens only UCR-50 is in good condition, the other two having fruited on decaying wood encrusted with lava dust which crumbles and results in the destruction of most sporangia thereon.

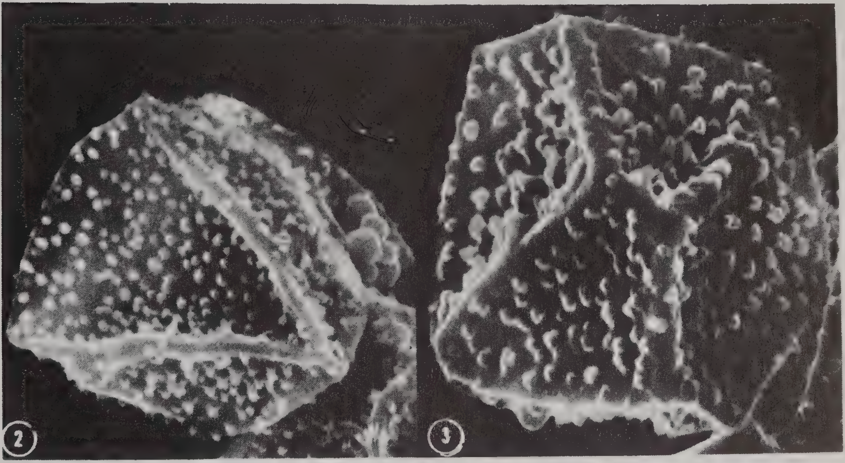
Badhamia Berk., Trans. Linn. Soc. 21:153. 1853.

1. Badhamia cinerascens Martin, Jour. Wash. Acad. 22:88. 1932.

KNOWN WORLD DISTRIBUTION: Colombia.

COSTA RICA: III, UCR-13 (TEX 2105), 11 V 1965. On bark. (Authentic specimen).

COMMENTS: This is the second world collection of this species reported in the literature and is the only specimen of a Badhamia from Costa Rica in our collection. Dr. G. W. Martin, who first described this species, concurred with our identification, noting, however, that ". . . the Costa Rican collection is more limy than the type and the spores somewhat smaller, but I can regard neither character as significant . . . Certainly I cannot assign your specimen to anything but B. cinerascens." Figures 2 and 3 are presented as further evidence in support of our identification.



Figures 2-3. Scanning electron micrographs of the spores of Badhamia cinerascens Martin.
Figure 2. Spore of UCR-13, X 4500
Figure 3. Spore from TYPE in IA, X 5070
(Magnifications approximate).

Fuligo Hall., Hist. Stirp. Helv. 3:110. 1768.

1. Fuligo megaspora Sturgis, Colo. Coll. Publ. Sci. 12:443. 1913.

KNOWN WORLD DISTRIBUTION: U.S.A., Guatemala, Europe, Congo, Pakistan.

COSTA RICA: IV (25), UCR-168 (TEX 1448), 9 IV 1964. On dead wood.

COMMENTS: A typical well-formed aethalium, 3 cm in length. Most spores measure 18 µm diam.

*2. Fuligo septica (L.) Wiggers, Prim. Fl. Holsat. 112. 1780.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: Widely distributed and very common. I (5), UCR-81 (TEX 1435), UCR-82 (TEX 1454), UCR-87 (TEX 1456), 8 VII 1963. II (19), UCR-83 (TEX 1455), 7 VII 1963. III, UCR-80 (TEX 1434), 4 VII 1963; IV, Welden, p. 97. V (31), UCR-182 (TEX 1436), 19 VI 1964, UCR-185 (TEX 1457), 20 VI 1964. VII, Welden, p. 97. (34), UCR-318 (TEX 1458), 16 XI 1965. All on wood or bark.

COMMENTS: In UCR-182 the lime of the cortex is white; in all others it is some shade of yellow. Differences in color of the cortex have been used to distinguish among varieties (Martin & Alexopoulos, 1969; Nannenga-Bremekamp, 1973) but the taxonomic significance of aethalial color can be determined only by careful culture work and genetic studies under controlled conditions. F. septica is relatively easy to grow in laboratory culture from spores to the plasmodial stage, but cultures sporulate unpredictably and only after a very long time.

Craterium Trent., in Roth, Catalecta Bot. 1:224. 1797.

1. Craterium leucocephalum (Pers.) Ditmar, in Sturm, Deuts. Fl. Pilze 1:21. 1813.

KNOWN WORLD DISTRIBUTION: Cosmopolitan

COSTA RICA: I (1), UCR-171 (TEX 1459), 3 VI 1964; (7) UCR-243 (TEX 1461), 6 XI 1964. II (16), UCR-279 (TEX 1462), 7 VI 1965. V (31), UCR-190 (TEX 1460), 18 VI 1964. VII (34), UCR-301 (TEX 1463), 16 IX 1965; (35), UCR-306 (TEX 1464), 19 XI 1965. UCR-171 on bark; UCR-243, 279, 190, on dead leaves; UCR-301 on living leaves; UCR-306 on dead wood.

COMMENTS: Considerable variation is encountered in this species in the shape and color of the sporangia and their method of dehiscence. In UCR-171, 190, and 279 the sporangia are essentially globose; in UCR-243 they are long goblet-shape; and in UCR-306 they are intermediate. In UCR-243 and 279 the brown base of the sporangium is clearly evident; in the others the sporangia are almost entirely white. The operculum is perfectly developed in UCR-243; in all others dehiscence is irregular. Whether the variations noted are genetically or environmentally controlled is not known.

Physarum Pers., Neues Mag. Bot. 1:88. 1794.

1. Physarum bitectum G. Lister, Mycet. ed. 2. 78. 1911.

KNOWN WORLD DISTRIBUTION: Western Europe, U.S.A., Puerto Rico, Colombia, South Africa, Australia, New Zealand.

COSTA RICA: I (10), UCR-287 (TEX 2113), 15 VII 1965, on dead leaf.

COMMENTS: This species is not commonly reported, but as Martin & Alexopoulos (1969) mention, it may be more widespread than is supposed because it often resembles other species such as P. bivalve and may be misdetermined. Our specimen appears to be typical. Dr. Marie L. Farr concurs with our identification.

2. Physarum bivalve Pers., Ann. Bot. Usteri 15:5. 1795.

KNOWN WORLD DISTRIBUTION: Europe, N. America, Chile, South Africa, Angola, Southeast Asia, Japan, Philippines, Samoa.

COSTA RICA: I (7), UCR-121 (TEX 1465), 9 VIII 1963, on dead wood, UCR-251 (TEX 1467), 6 XI 1964, on dead leaves. V (31), UCR-183 (TEX 1466), 20 VI 1964, on dead leaves.

COMMENTS: UCR-251 is the most typical of the three specimens, consisting both of isolated sporangia and variously shaped plasmodiocarps of different lengths. The most interesting of the three specimens, however, is UCR-183 in which all the sporophores are in the form of bright yellow, clam-shaped sporangia.

3. Physarum bogoriense Racib., Hedwigia 37:52. 18F. 1898.

KNOWN WORLD DISTRIBUTION: Known from all continents but particularly abundant in the tropics and subtropics.

COSTA RICA: I (1), UCR-205 (TEX 1471), 28 IX 1964, on herbaceous stem, UCR-98 (TEX 1469), 29 VII 1963, on mossy bark, UCR-147 (TEX 1470), 18 X 1963, on dead leaf. II (17), Orotima, UCR-281 (TEX 1473), 9 VI 1965, on dead leaf. III (22), UCR-220 (TEX 1472), 1 X 1964, on plant debris. IV, UCR-64 (TEX 1468), 24 VI 1963, on leaf base.

COMMENTS: This distinctive species fruits occasionally on bark or wood but usually on dead leaves and plant debris.

The yellowish or brown outer peridium and the stellate dehiscence make it easy to recognize in the field under a hand lens. Only occasionally encountered in cold climates, it is one of the most abundant species in warm regions.

4. Physarum cinereum (Batsch) Pers., Neues Mag. Bot. 1:89. 1794.

KNOWN WORLD DISTRIBUTION: Cosmopolitan and very common.

COSTA RICA: I (1), UCR-172 (TEX 2233), 3 VI 1964; (7), UCR-244 (TEX 1475), 6 XI 1964, both on living leaves, San Antonio de Belem, UCR-329 (TEX 1487), 3 VII 1966, on dead wood.

COMMENTS: In UCR-244 the sporangia are well formed but the lime is scanty and the peridium is iridescent; the spores measure 7-9 µm. In UCR-239 the lime is much more abundant and there are two long, branched plasmodiocarps in addition to the few sporangia. One is tempted to place this specimen in the closely allied P. vernum, but the spores are clearly brownish-violaceous rather than dark purplish-brown; it seems better, therefore, to retain it in P. cinereum in spite of its occurrence on wood. UCR-172 is a scanty collection of but a few sporangia. The spores are not well formed and the determination is therefore tentative.

5. Physarum citrinum Schum., Enum. Pl. Saell. 2:201. 1803.

KNOWN WORLD DISTRIBUTION: Cosmopolitan but not common.

COSTA RICA: I (11), UCR-240 (TEX 1474), 16 X 1964, on wood.

COMMENTS: Our specimen, consisting of over 100 sporangia, is typical in some respects, not so in others. The sporangia are .7-1 mm diam.; the stalks are short and calcareous but tend to be more orange than yellow in color; the columella is minute and conical but the capillitial nodes are elongated. The spores are almost smooth and measure 11-12 µm, which is somewhat larger than described. New species have been described on smaller differences!

6. Physarum compressum Alb. & Schw., Consp. Fung. 97. 1805.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-30 (TEX 2010), 3 VI 1963, UCR-36 (TEX 1479), 6 VI 1963, UCR-206 (TEX 1484), 28 IX 1964, all on bark; UCR-140 (TEX 1481), 10 VIII 1963, on lizard dung in moist chamber; UCR-169 (TEX 1482), 10 IV 1964, on plant debris; (10), UCR-141 (TEX 1480), 4 X 1963, on dead wood; III (22), E. F. M. #902 (TEX 1994), 18 II 1966, on dead herbaceous stem; III (23), UCR-286 (TEX 1485), 15 VII 1965, on moss.

COMMENTS: This ubiquitous species is a very variable one and several of its forms have been described as new species or have been confused with other Myxomycetes. Typically the sporangia are fan-shaped, as in UCR-286, but plasmodiocarpous fruitings, as in UCR-141 and 200 are not uncommon. Polycephaloid fruitings which resemble _P. nicaraguense_ (q. v.) are sometimes produced; UCR-36 is a good example of this variation. Culture studies (Alexopoulos, 1969) have shown that spores taken from various types of fruiting bodies, such as those described above, will yield the typical fan-shaped sporangia when conditions for fruiting are favorable.

*7. _Physarum_ _decipiens_ Curtis, Am. Jour. Sci. II. 6:352. 1848.

KNOWN WORLD DISTRIBUTION: U.S.A., Canada, South America, Western Europe to Greece; Hawaii, Asia, Australia.

COSTA RICA: Heredia (Reported by Welden, 1954 as _Badhamia decipiens_ (Curt.) Berk. No specimen in our collection).

8. _Physarum_ _dictyosporum_ Martin, Brittonia 14:183. 1962.

KNOWN WORLD DISTRIBUTION: U.S.A. (Michigan, Iowa, Kansas, Texas).

COSTA RICA: V (31), UCR-186a (TEX 1486), 20 VI 1964, on dead leaf.

COMMENTS: This is one of the very few species of _Physarum_ with reticulate spores. In our specimen, short plasmodiocarps intermingle with sessile sporangia. The lime in the sporophore is often concentrated in the center forming a rigid pseudocolumella which assumes the shape of the fruiting body. This species, discovered in 1962, has hitherto been known only from four localities in the U.S.A. as noted above.

*9. Physarum didermoides (Pers.) Rost., Mon. 97. 1875.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-1 (TEX 1488), January 1963, UCR-261 (TEX 919), 28 X 1964, UCR-84 (TEX 1492), 9 VII 1963, both on bark; UCR-112 (TEX 1493), 3 VII 1963, on wood covered with moss; UCR-145 (TEX 1517), 18 X 1963, on bark. (4), Rio Claro, UCR-4 (TEX 1489), April 1963, on plant debris. II (19), UCR-165 (TEX 2232), 4 IV 1964, on moss. III, UCR-18 (TEX 1490), 20 V 1963; (22), UCR-213 (TEX 1495), UCR-217 (TEX 1496), UCR-218 (TEX 1497), 1 X 1964, all on bark. VII (34), UCR-300 (TEX 1498), UCR-312 (TEX 1499), 16 XI 1965, on dead leaves.

COMMENTS: All specimens except UCR-145 and 261 are typical of the species. Those two approach P. tesselatum in that the sporangia are somewhat flatened, approximately isodiametric, and crowded together. However, the tesselate crust formed by the contacting sporangia of P. tesselatum is absent in both specimens and we must therefore, consider all as belonging to P. didermoides. It is of interest to note that laboratory cultures of the aberrant forms produced the same type of fructifications. This is another of the relatively few species of Myxomycetes that grow readily in culture from spores.

10. Physarum flavidum (Peck) Peck, Ann. Rep. N. Y. State Mus. 31:55. 1879.

KNOWN WORLD DISTRIBUTION: N. America, Europe, Japan.

COSTA RICA: I (21), UCR-106 (TEX 1501), 26 XII 1963, on mosses and lichens.

COMMENTS: Although it appears to be widely distributed, this is not a common species. Our specimen--the first on record south of the United States in the Western hemisphere--is typical in all respects except the capillitial nodes which are not white-calcareous but translucent and amber-like. It may be that the sporangia are not properly matured, but the uniformity of the spores argues against that hypothesis. Experimental culture work would answer this question, but unfortunately we were unable to obtain cultures from this specimen.

11. Physarum globuliferum (Bull.) Pers. Syn. Fung. 175. 1801.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (2), UCR-11 (TEX 1502), X 1962, on dead wood. V (31), UCR-179 (TEX 1573), 20 X 1964, on plant debris. VII (36), E.F.M. #956 (TEX 1993), 12 III 1966, on bark.

COMMENTS: The first two collections are scanty, consisting of but a dozen fragile sporophores each. The E. F. Morris specimen is somewhat more ample. All appear typical, but the sporophores of UCR-11 lack columellae.

12. *Physarum javanicum* Racib., Hedwigia 37:53. 1898.

KNOWN WORLD DISTRIBUTION: Java, Africa, Florida, California, Jamaica, Trinidad, Colombia, England.

COSTA RICA: I (1), UCR-194 (TEX 1503), 11 IX 1964, on lava dust on dead wood.

COMMENTS: This is another scanty collection of about a dozen sporophores. The sporangia are not turbinate but vertically compressed and conspicuously umbilicate above. The lava dust is crumbling and the specimen is virtually destroyed.

13. *Physarum ?leucopus* Lk. Ges. Nat. Freunde Berlin Mag. 3:27. 1809.

KNOWN WORLD DISTRIBUTION: Cosmopolitan but apparently rare in the tropics.

COSTA RICA: II (18), UCR-278 (TEX 2192), 8 VI 1965, on dead leaf.

COMMENTS: Dr. Marie L. Farr confirmed our identifications but reaffirmed our reservations. We quote from her commentary: "Appears to fit except for *cylindrical* columellae present in some sporangia. Also characteristic whitish color of hypothallus absent; some sporangia have irregular pseudocolumella." Farr also questioned the identity of her own specimen from Dominica (Farr, 1969), but decided that both the Dominica and Costa Rica specimens fit in *P. leucopus* better than in any other species.

14. Physarum melleum (Berk. & Br.) Massee

KNOWN WORLD DISTRIBUTION: Cosmopolitan; common in the tropics.

COSTA RICA: I (1), UCR-142 (TEX 1504), 11 XI 1963; (7), UCR-242 (TEX 1506), 6 XI 1964. II (16), UCR-273 (TEX 2108), 7 VI 1965; (17), UCR-283 (TEX 1507), 9 VI 1965. V (31), UCR-175 (TEX 2117), 20 VI 1964, UCR-177 (TEX 1505), 20 VI 1964.

COMMENTS: Physarum melleum is a variable species in several of its taxonomically important characters such as color of the sporophore, length of stalk, size of columella and presence of a pseudocolumella. These variations are represented in the specimens at hand. The stalk in UCR-142, 242, and 175 is pure white in most sporangia although it has a tendency to become cream-colored in some sporophores of UCR-175; it is of a light cream color in UCR-177 and more yellow in UCR-273 and 283; it may be described as relatively long in all specimens except UCR-242 in which it is medium to short. The peridium is bright yellow from an abundance of lime in UCR-142, 273 and 283, but gray or white in the other specimens. The whole sporophore is grayish white in UCR-175. The columella is small in most specimens, but conspicuous and yellow in UCR-142 and quite conspicuous and pure white in UCR-175. The capillitium is abundant with angular, white nodes in all specimens but UCR-273 in which it is less abundant and has yellowish nodes. The spores are uniformly light violet-brown and very minutely warted in all specimens. They vary in size from 7.5 to 9 µm in diameter. In spite of the variation, this species is one of the easiest to recognize in the genus.

15. Physarum murinum A. Lister Mycet. 41. 1894.

KNOWN WORLD DISTRIBUTION: Western Europe, U.S.A.

COSTA RICA: IV (24), UCR-151 (TEX 1969), 21 XI 1963, on decaying wood.

COMMENTS: This appears to be the only report of P. murinum from the tropics. Both Dr. G. W. Martin and Dr. Marie L. Farr, who examined our specimen, agree with our identification in spite of some characters which deviate from the typical.

16. Physarum nicaraguense Macbr. Bull. Nat. Hist. Univ. of Iowa 2:382. 1893.

KNOWN WORLD DISTRIBUTION: Nicaragua, West Indies, Ceylon, India, Japan, Philippines, Caroline Islands.

COSTA RICA: I (2), UCR-14 (TEX 1511), 18 V 1963, UCR-16 (TEX 1512), 18 V 1963; (10), UCR-139 (TEX 1508), 4 X 1963. III (22), UCR-216 (TEX 1441), 1 X 1964. VII (Orotina), UCR-285 (TEX 1442), 9 VI 1965. All on bark.

COMMENTS: Physarum nicaraguense appears to be a strictly tropical species. Its occurrence in Costa Rica was expected in view of the fact that Nicaragua is its type locality. We find it to be a well-defined species, apt to be confused only with some aberrant forms of Physarum compressum (q. v. See also comments in Martin and Alexopoulos, 1969, p. 315).

17. Physarum notabile Macbr. N. Am. Slime-Moulds ed. 2. 80. 1922.

KNOWN WORLD DISTRIBUTION: U.S.A. and Canada, West Indies, Europe, ?New Zealand.

COSTA RICA: I (7), UCR-124 (TEX 2005), 9 VIII 1963. II (19), UCR-164 (TEX 1510), 4 IV 1964. Both on bark.

COMMENTS: UCR-124 does not agree perfectly with the description of this species but cannot be placed elsewhere with more certainty. Dr. Marie L. Farr agrees with this view. UCR-164 is more typical.

18. Physarum nucleatum Rex, Proc. Acad. Phila. 43:389. 1891.

KNOWN WORLD DISTRIBUTION: Throughout the U.S.A. and south to Nicaragua, England, Rumania, South Africa, Hawaii, Japan, the tropics in general.

COSTA RICA: VI (32), UCR-224 (TEX 1575), 2 X 1964, on moss.

COMMENTS: An ample and typical collection. Pseudocolumellae are present but are not prominent.

19. Physarum nutans Pers., Ann. Bot. Usteri 15:6. 1795.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (7), UCR-137 (TEX 1925), 9 VIII 1963, UCR-128 (TEX 2001), 9 VIII 1963; (1), UCR-58 (TEX 2000), 24 VI 1963; (8), UCR-255 (TEX 2003), 5 XI 1964; (23), UCR-202 (TEX 2004), 24 IX 1964, UCR-209 (TEX 918), 26 IX 1964. IV (24), UCR-154 (TEX 2002), 24 XI 1963. UCR-58, 128, 154, and 255 are on bark; UCR-202 is on mossy wood; the others are on dead wood.

COMMENTS: Physarum nutans, a very common species thoughout the world, closely resembles P. viride in all characters except color, being gray or white instead of yellow or orange (See Martin & Alexopoulos, 1969). Color differences within the same species have been recorded for Physarella oblonga, Physarum tenerum, Arcyria cinerea and other species of Myxomycetes, and are usually not recognized as separate taxa unless and until experimental evidence indicates the differences hold up under different conditions of culture and are not merely due to changes in the environment. No such evidence has been obtained for the P. nutans/viride complex, chiefly because neither species has been grown in laboratory culture after repeated attempts. All our specimens appear to be typical of P. nutans as this taxon is presently circumscribed.

20. Physarum polycephalum Schw., Schr. Natur. Ges. Leipzig 1:63. 1822.

KNOWN WORLD DISTRIBUTION: Common in the U.S.A., West Indies, Brazil, Uruguay, Angola, France, Rumania, Borneo, Japan.

COSTA RICA: I (1), UCR-26 (TEX 1983), UCR-115 (TEX 1987), UCR-116 (TEX 1980), UCR-117 (TEX 1984), all four collected on 5 VII 1963; (11), UCR-233 (TEX 446), 16 X 1964. III (Cartago), UCR-163 (TEX 1981), 16 X 1964. IV (24), UCR-6 (TEX 1421); (27), UCR-324 (TEX 1422), 10 VI 1966. VII (33), UCR-292 (TEX 1982), 17 XI 1965; (Monte Verde), E.F.M. #858 (TEX 1992), 9 II 1966. Cocos Island, W. A. Weber # M-194 (TEX 1207), Jan-Mch 1964. The habitats of our specimens are as follows: On herbaceous material: UCR-233, 292, 324; on bark: UCR-6 and TEX 1207; on dead wood: UCR-26, 115; on dead leaf: UCR-325; on lichen and moss: E.F.M. #858; on debris in moist chamber: UCR-163, 324; collected as plasmodia and fruited on filter paper: UCR-116, 117.

COMMENTS: Physarum polycephalum exists in two forms and at least two colors in nature. One form is polycephaloid; the other is simple. The latter has been called Physarum obrusseum (Berk & Curtis) Rost. and Physarum polycephalum Schw. var. obrusseum (Berk. & Curtis) G. Lister. Experimental evidence (Alexopoulos, 1969) supports the view that these are but variants of P. polycephalum Schw. which do not deserve separate designations. In color, P. polycephalum sporangia are either yellow to orange or gray to white. The color and type of fructification in our specimens are as follows: Obrusseum type, gray: UCR-6, 117, 324; yellow: TEX 1207; yellowish gray: UCR-116. Polycephaloid type, gray: UCR-292, 325, E.F.M. #858; yellow: UCR-115; yellowish gray: UCR-26. The sporangia of UCR-163 are not well matured and were still black when collected.

21. Physarum pulcherripes Peck, Bull. Buffalo Soc. Nat. Sci. 1:64, July, 1873.

KNOWN WORLD DISTRIBUTION: U.S.A., Panama, Jamaica, Dominica, Trinidad, Ireland, Japan.

COSTA RICA: VII (34), UCR-317 (TEX 2015), 16 IX 1965, on dead wood.

COMMENTS: The identification of this specimen is uncertain. It was first determined by us as Physarum psittacinum Ditmar and Dr. G. W. Martin agreed that it was probably that although both he and we noted it did not fit the description of that species perfectly. Later, Dr. Marie L. Farr redetermined this specimen as P. pulcherripes noting "Columella absent and lime nodes more as in P. psittacinum, but stipes decidedly limy." Thus, the specimen appears to be intermediate between the two species. We are at present filing it under P. pulcherripes.

22. Physarum rigidum (G. Lister) G. Lister, Mycet., ed. 3. 36. 1925.

KNOWN WORLD DISTRIBUTION: Japan, Philippines, Hawaii, U.S.A. (Texas), West Indies, Brazil, Uruguay.

COSTA RICA: I (23), UCR-210 (TEX 2114), 26 XI 1964; (11), UCR-239 (TEX 1220), 16 X 1964.

COMMENTS: Physarum rigidum was first described as a variety of P. viride whose capillitium often consists of rod-like, rigid tubes containing lime granules. Although the capillitium of our specimens lacks these rigid tubes, it does consist of sparingly branched threads arising vertically from the base of the sporangium and bearing long, orange-yellow nodes. In this respect our specimen approaches P. viride (q. v.) but in its limeless peridia it strongly resembles P. flavicomum where we had originally placed it. The capillitium of P. flavicomum is intermediate between those of P. viride and P. rigidum. It is obvious that what might be called the P. viride/rigidum/flavicomum complex requires much experimental study before the relationships can be untangled. We are basing the identification of our specimens on the conclusions reached by Henney & Henney (1968) who attempted unsuccessfully to cross clones derived from UCR-239 with clones of P. flavicomum. Unfortunately, no one has succeeded in growing P. viride in laboratory culture.

23. Physarum stellatum (Massee) Martin, Mycologia 39:461, 1947.

KNOWN WORLD DISTRIBUTION: North and South America, West Indies, Africa, Hawaii, Philippines, Indonesia, Asia.

COSTA RICA: III (22), UCR-223 (TEX 2012), IX 1964. VII (33), UCR-291 (TEX 2011), 17 XI 1965; (35), UCR-305 (TEX 2013), 19 XI 1965. All on wood.

COMMENTS: The pseudocolumella, characteristically present in this species, is conspicuously present in the first two specimens, not so in the third which is in poor condition. All other characters are typical in all three.

*24. Physarum tenerum Rex Proc. Acad. Phila. 42:192. 1890.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-49 (TEX 2008), 8 VI 1963, UCR-54 (TEX 2007), 11 VI 1963, UCR-37 (TEX 2009) 3 VI 1963, UCR-58 (TEX 2107), 24 VI 1963; (8) UCR-253a (TEX 1416), 5 XI 1964. IV (El Roble), UCR-94 (TEX 2006), 30 VII 1963; IV (Heredia), UCR-61 (TEX 2106), 24 VI 1963. All on bark except UCR-94 on a fungus sporophore.

COMMENTS: This is another species of Physarum with two color forms: yellow and gray to white. The colors of our specimens are as follows: Yellow form - UCR-253a, 94, 58, 61; white form - UCR-37, 49.

25. Physarum ?vernum Somm., in Fries, Syst. Myc. 3:146. 1829.

KNOWN WORLD DISTRIBUTION: Western Europe and the British Isles, Rhodesia, Angola, India, Japan, Hawaii, South Australia, New Zealand, Mexico, Cuba.

COSTA RICA: II (16), UCR-177 (TEX 2014), 7 VII 1965, on bark.

COMMENTS: Physarum vernum resembles both P. cinereum and P. sessile, but is usually more plasmodiocarpous than the former and has larger spores than the latter. Our specimen consists of three plasmodiocarps 1.5 to 2 mm long and about 0.4 mm in diameter. The spores measure 8-10 µm. The sporophores are heavily encrusted with lime. The capillitial nodes are rather large and angular. Obviously the specimen is intermediate between P. vernum and P. cinereum, but we believe it to be closer to the former. Dr. Marie L. Farr concurs.

26. Physarum viride (Bull.) Pers., Ann. Bot. Usteri 15:6. 1795.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-149 (TEX 2110), 18 X 1963, UCR-238 (TEX 2111), 16 X 1963; (7), UCR-123 (TEX 2112), 9 VIII 1963. V (31), UCR-180 (TEX 2109), 20 VI 1964. All on dead wood.

COMMENTS: Except for its similarity in structure to P. nutans (q. v.) this is a well-defined species which may generally be easily recognized by the petaloid dehiscence of the peridium with patches left clinging to the capillitial mass. All our specimens are typical.

Family DIDYMIACEAE Rost., Versuch. 12, 1873.

Diachea Fries, Syst. Orb. Veg. 143. 1825.

Fries first described *Diachea* in 1825 as a member of his Trichiacei but three years later in his Systema he transferred it to the Stemonitei where it remained until Rostafinski (1874) placed it in the family Spumariaceae of his Calcareae (now order Physarales). (See Martin & Alexopoulos, 1969, p. 176). In this decision Rostafinski was followed by Cooke (1877) and partly by Zopf (1885) who placed *Diachea* in the Didymiaceae. Massee (1892) continued to regard *Diachea* as one of the Didymiaceae. All these authors obviously emphasized the presence of lime (a physaraceous character) more than the type of capillitium and peridium which, in *Diachea*, resemble those of the Stemonitales.

Lister, in all three editions of his monograph The Mycetozoa, placed *Diachea* in the Physaraceae, but mentions (1911, 1925) that "this genus forms a connecting link between the Calcarineae and the Stemonitaceae." Morgan (1894) in the meantime, had transferred it back to the Stemonitaceae emphasizing its resemblance to *Lamproderma* except for the limy stalk and columella. The European monographers continued to classify this genus in the Physarales, both Schinz (1920) and Krzemieniewska (1960) including it however, in the Physaraceae, following Lister. American monographers, on the other hand (Macbride, 1899, 1922; Macbride & Martin, 1934; Martin, 1949; Martin & Alexopoulos, 1969; Alexopoulos, 1973) followed Morgan, the one exception being Hagelstein (1944) who used Lister's classification throughout, patterned, with few modifications, after Rostafinski.

By 1973, the basis for classification of the Myxomycetes was placing more emphasis on the development of the sporophore (deBary, 1859; Ross, 1957, 1960, 1961, 1973; Alexopoulos, 1969, 1973) rather than on the characters of the mature fructification alone as had been done until recent years. In that year (1973) Blackwell examined the stalk structure of the mature sporophore of *Diachea leucopodia* with the electron microscope and concluded that the development is "nonstemonitaceous" (subhypothallic) and that ". . . *Diachea* (is) misplaced in the Stemonitomycetidae." Shortly thereafter, Farr (1974) on the basis of other features, also suggested that "*Diachea* seems . . . more naturally and compatibly placed in the Physarales, family Didymiaceae, rather than in the Stemonitaceae." With these conclusions we concur and, therefore, classify *Diachea* in the Didymiaceae, recognizing, at the same time, that there is merit in considering the erection of a new family for this intermediate genus.

1. *Diachea bulbillosa* (Berk. & Br.) A. Lister, in Penzig, Myxom. Buit. 45. 1898.

KNOWN WORLD DISTRIBUTION: Southern and Eastern Asia, Eastern Canada, U.S.A., Central America, West Indies, Colombia.

COSTA RICA: V (31), UCR-176 (TEX 1369), 20 VI 1964. VI (37), E. F. Morris # 907 (TEX 1990), 20 II 1966. Both on living leaves.

COMMENTS: A recently described taxon from Dominica, W. I. (*D. silvaepluvialis* Farr, 1969) differs from this species chiefly in the brown sheathlike covering over the calcareous stipe. All specimens hitherto described as *D. bulbillosa* should be reexamined for this character. In our specimens all stalks are white and our identifications were checked by Dr. Farr herself.

2. *Diachea leucopodia* (Bull.) Rost., Mon. 190. 1874.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (7), UCR-120 (TEX 1370), 9 VIII 1963, UCR-263 (TEX 1371), 6 XI 1964. IV (27), UCR-320 (TEX 1372), 10 VI 1966. All three on living leaves. VII (38), E. F. Morris # 846 (TEX 1997), 8 II 1966, on dead grass culms.

COMMENTS: All specimens are typical. The species is hard to confuse with any other.

Diderma Pers., Neues Mag. Bot. 1:89. 1794.

*1. *Diderma chondrioderma* (deBary & Rost.) G. Lister, in Lister, Mycet. ed. 3. 258. 1925.

KNOWN WORLD DISTRIBUTION: Great Britain, Poland, Rumania, U.S.A., Galapagos Islands, Ceylon, Malaya, Japan.

COSTA RICA: V (?), Welden, p. 98.

COMMENTS: We have no specimen from Costa Rica in our collections.

2. *Diderma effusum* (Schw.) Morgan, Jour. Cinc. Soc. Nat. Hist. 16:155. 1896.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: V (31), UCR-181 (TEX 2194), 19 VI 1964. On leaf.

COMMENTS: This is a typical specimen of a very common and widely distributed species.

3. *Diderma hemisphaericum* (Bull.) Hornem., Fl. Dan. 33:3. 1829.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-173 (TEX 2115), 3 VI 1964. II (16), Carretera panamericana (La Azucena), UCR 298 (TEX 2116), 19 XI 1965. UCR-275b (TEX 1405), 7 VI 1965.

COMMENTS: All three specimens of this easily recognized species are typical.

4. *Diderma ?sauteri* (Rost.) Macbr., N. Am. Slime-Moulds. 103. 1899.

KNOWN WORLD DISTRIBUTION: Scotland, Austria, Rumania, Eastern North America.

COSTA RICA: I (1), UCR-235 (TEX-specimen misplaced).

COMMENTS: Martin & Alexopoulos (1969) state that this is a very rare species. Our specimen, if indeed it belongs here, is the first one reported from the tropics. It has a calcareous peridium on the basis of which Dr. G. W. Martin disagreed with our identification without, however, assigning our specimen to another known species. Later, Dr. Marie L. Farr expressed the opinion that our identification was probably correct. We place this specimen tentatively in D. sauteri for lack of a better suggestion. The specimen deposited in the Texas herbarium has been misplaced; the one in the University of Costa Rica herbarium is available.

5. Diderma testaceum (Schrad.) Pers. Syn. Fung. 167. 1801.

KNOWN WORLD DISTRIBUTION: N. America, Jamaica, Dominican Republic, Chile, Europe, Japan, Ceylon, India.

COSTA RICA: VII (34), UCR-304 (TEX 1399), 16 XI 1965. On leaf fragment.

COMMENTS: The glossy peridium and the large columella are unmistakable characters of this ubiquitous species. Our sporangia are pure white.

Didymium Schrad., Nov. Gen. Pl. 20. 1797.

*1. Didymium clavus (Alb. & Schw.) Rab. Deuts. Krypt. Fl. 1:280. 1844.

KNOWN WORLD DISTRIBUTION: Europe, U.S.A., West Indies, Ceylon.

COSTA RICA: I (1), UCR-74 (TEX 2234), 4 VII 1963, UCR-198 (TEX 2238), 16 IX 1964. III (23), UCR-272 (TEX 2236), 10 VI 1965. VII (34), UCR-313 (TEX 2237), 16 XI 1965. All on dead wood, those of UCR-74 and 198 covered with lava dust.

COMMENTS: The sporangia of UCR-272 are the most typical being decidedly umbilicate above and much depressed. The others tend to be more subglobose, approaching those of D. minus.

2. Didymium crustaceum Fries, Syst. Myc. 3:124. 1829.

KNOWN WORLD DISTRIBUTION: Great Britain, Central Europe, Canada, U.S.A., West Indies, South America, Angola, India.

COSTA RICA: III (23), UCR-199 (TEX 2239), 26 IX 1964, on mossy bark.

COMMENTS: Our specimen consists of two small sporangial clusters and two single sporangia. All are sessile with very limy peridia.

3. Didymium difforme (Pers.) S. F. Gray, Nat. Arr. Brit. Pl. 1:571. 1821.
KNOWN WORLD DISTRIBUTION: Europe, temperate N. America, W. Indies, S. America, Japan.

COSTA RICA: I (7), UCR-250 (TEX 2240), UCR-252 (TEX 2193), both on 6 XI 1964; (10), UCR-258 (TEX 2241), 15 VII 1965. Caretera Panamericana (La Azucena), UCR-299 (TEX 2242), 19 XI 1965. All on dead leaves.

COMMENTS: This is a widely distributed, probably cosmopolitan species and, therefore, quite variable, sometimes approaching Diderma testaceum in its general appearance (See Martin & Alexopoulos, 1969, p. 384).

4. Didymium iridis (Ditmar) Fr., Syst. Mycol. 3:120. 1829.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1) UCR-5 (TEX 2243), January 1963, on dead wood, UCR-332 (TEX 2235), 2 XI 1967, on seeds of Ricinus communis in moist chamber, (La Palma) E. F. Morris # 992 (TEX 1985), 27 II 1966, on dead herbaceous plant; (9), UCR 271 (TEX 2246), 1 VI 1965, on dead leaves. II (16), UCR-280 (TEX 2247), 7 VI 1965, on dead leaf; (19), UCR-166 (TEX 2244), 4 IV 1964, on moss. V (31), UCR-189 (TEX 2245), 18 VI 1964, on dead leaves. VI (37), G. C. Carroll (TEX 414, m. ch. cult. # Co-27), 18 IX 1964, on decaying wood in moist chamber.

COMMENTS: This species closely resembles D. nigripes differing from it chiefly in having a white rather than dark columella, a character that appears to be constant under a variety of environmental conditions. D. iridis is one of the best known of all myxomycete species, having been collected all over the globe. It grows and sporulates easily in laboratory culture on artificial media and its genetics have been intensively studied by Collins and his associates who found both homothallic and heterothallic strains. Its spore development has been recently investigated by Aldrich (1974).

5. Didymium minus (A. Lister) Morgan, Jour. Cinc. Soc. Nat. Hist. 16:145. 1894.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (7), UCR-249 (TEX 2188), 6 XI 1964. Carretera Panamericana, (La Azucena), UCR-295 (TEX 2248), 19 XI 1965. Both on dead leaves.

COMMENTS: UCR-295 is moldy and less typical in its general appearance than UCR-249. The latter is quite typical except for its spores which are somewhat smaller (7-7.5 µm) than described for this species (8-11 µm).

6. Didymium nigripes (Link) Fries, Syst. Myc. 3:119. 1829.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (9), UCR-269 (TEX 2189), 1 VI 1965. VII (34), UCR-302 (TEX 2190), 16 XI 1965. Both on dead leaves.

COMMENTS: See comments under D. iridis to which this species appears to be most closely related.

7. Didymium squamulosum (Alb. & Schw.) Fries, Symb. Gast. 19. 1818.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-150 (TEX 2249), 22 X 1963, on living leaves, UCR-226 (TEX 2250), 9 X 1964, on dead leaves; (7), UCR-262 (TEX 2251), 6 XI 1964, on herbaceous stem; (9), UCR-270 (TEX 2252), 1 VI 1965, on dead leaves. Caretera Panamericana (La Azucena), UCR-296 (TEX 2253), 19 XI 1965, on plant debris.

COMMENTS: All specimens are typical of this unmistakable species. This is one of the relatively few Myxomycetes which can be cultured easily in the laboratory.

Subclass STEMONITOMYCETIDAE Ross, Mycologia 65:483. 1973.

Order STEMONITALES Macbride, N. Am. Slime-Moulds, ed. 2. 122. 1922.

Family STEMONITACEAE Rost., Versuch. 6. 1873 (as Tribus).

Stemonitis Roth, Mag. Bot. Rommer & Usteri I (2):25. 1787.

1. Stemonitis axifera (Bull.) Macbr., N. Am. Slime-Moulds 120. 1889.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-22 (TEX 1373), 21 V 1963, UCR-47 (TEX 1375), 8 VI 1963; (8), UCR-265 (TEX 1377), 5 XI 1964. II (12), UCR-35b (TEX 1374), 1 VI 1963. III (21), UCR-65 (TEX 1376), 28 VI 1963; (22), UCR-232 (TEX 1387), 1 X 1964. All on dead wood.

COMMENTS: Stalk length varies greatly in this species. In UCR-22, for example, the stalks are 0.45-1.5 mm high, whereas in UCR-47 they are 3-4 mm. UCR-265 exhibits the membranous expansions in the capillitium, supposedly characteristic of S. flavogenita, and larger surface net meshes than usually found in S. axifera, but the spores place it in the latter species.

2. Stemonitis flavogenita Jahn, Verh. Bot. Ver. Brand. 45:165. 1904.

KNOWN WORLD DISTRIBUTION: U.S.A., West Indies, Panama, Brazil, Europe, Asia, Africa.

COSTA RICA: VII (35), UCR-310 (TEX 1379), 19 XI 1965; (34), E. F. Morris #971 (TEX 1999), 16 III 1966. Both on decaying wood.

COMMENTS: Both specimens agree as closely as can be expected with the description of this variable species.

3. Stemonitis fusca Roth, Mag. Bot. Romer & Usteri 1 (2): 26. 1787.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-88 (TEX 1381), 7 VII 1963. II (12), UCR-35a (TEX 1380), 1 VI 1963. VI (37), Coll. by G. C. Carroll (TEX 224), 18 IX 1964. III (20), UCR-15 (TEX 388), 20 V 1963; (22), E. F. Morris #897 (TEX 1989), 18 II 1966. VII (34), UCR-316 (TEX 1484), 16 XI 1965. All on dead wood.

COMMENTS: UCR-35a probably represents the variety papillosa. The spores are not reticulate but papillate, the papillae clearly evident only under the oil immersion objective, particularly with phase contrast optics.

4. Stemonitis herbatica Peck, Ann. Rpt. N. Y. State Mus. 26:75. 1874.

KNOWN WORLD DISTRIBUTION: N. America, Jamaica, Brazil, Europe, Africa, Fiji.

COSTA RICA: VI (32), UCR-1481 (No specimen in TEX), 1 VI 1972, on both mossy dead wood and living grass. VII (33), UCR-294 (TEX 1378), 17 XI 1965, on herbaceous stem.

COMMENTS: Both our specimens are typical of the species.

5. Stemonitis splendens Rost. Mon. 195. 1874.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-23 (TEX 1385), 21 V 1963, on wood, UCR-52 (TEX 1386), 8 VI 1963, on bark (?).

COMMENTS: In UCR-23 the sporangia are partly agglutinated.

Lamproderma Rost., Versuch. 7. 1873.

1. Lamproderma arcyrionema Rost., Mon. 208. 1874.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-45 (TEX 1400), UCR-46a (TEX 2191), 8 VI 1963; (7), UCR-248 (TEX 1402), 6 XI 1964; (11), UCR-237 (TEX 1401), 16 X 1964. II (14), UCR-134 (TEX 1396), 17 VIII 1963. VII (34) E. F. Morris #968 (TEX 1988), 16 III 1966. All on dead wood.

COMMENTS: The stalks of UCR-237 are somewhat shorter than usual, constituting about 1/2 to 3/5 of the total height of each sporophore.

2. Lamproderma muscorum (Lev.) Hagelst., Mycologia 27:88. 1935.

KNOWN WORLD DISTRIBUTION: Colombia.

COSTA RICA: II (16), UCR-274 (TEX 1433), 7 VI 1965, on dead leaf. Det. by G. W. Martin.

COMMENTS: Martin & Alexopoulos (1969) say of this particular collection: "A very fine collection . . . from Costa Rica . . . appears to be the closest approach to what Léveillé described that we have seen."

3. Lamproderma scintillans (Berk. & Br.) Morgan.

KNOWN WORLD DISTRIBUTION: Southern Canada, U.S.A., West Indies, Panama, S. America, Galapagos, Great Britain, Germany, Southern and Eastern Asia, Hawaii.

COSTA RICA: I (1), UCR-29 (TEX 1397), 31 V 1963; (9), UCR-135 (TEX 1403), 20 IX 1963. II (16), UCR-275a (TEX 1404), 7 VI 1965; (17), UCR-282 (TEX 1406), 9 VI 1965. All on dead leaves.

COMMENTS: The sporangia of this species are described by Lister (1925) as "steel blue, red or bronze, brilliantly iridescent." This variation in color is sometimes noted in a single sporangial group presumably developed from a single plasmodium, as in our UCR-29 in which both blue and bronze sporangia are found on the same small leaf fragment. In UCR-275a, except for a few blue sporangia on the margin of the leaf, all are bright golden in color. So are those of UCR-282 in which the peridium still persists. In UCR-135 most sporangia are not fully mature. The majority are violet-blue.

One might be tempted to conclude from a study of our specimens that the bronze or golden color is that of the fully and properly matured sporangia and that the violet and blue tints represent earlier stages in sporangial development. This is another case where extended experimental studies in artificial culture would be most helpful. The species has been grown in the laboratory by Alexopoulos (TEX 268, culture) and by Kalyandasundaram (1974), but it is difficult to maintain in culture and no experimental studies have been conducted.

Comatricha Preuss, Linnaea 24:140. 1851.

*1. Comatricha aequalis Peck. Ann. Rpt. N. Y. State Mus. 31:42. 1879.

KNOWN WORLD DISTRIBUTION: U.S.A., Costa Rica, Jamaica, Europe.

COSTA RICA: VII (?), Welden, p. 97.

COMMENTS: We have no specimen from Costa Rica in our collections.

2. Comatricha elegans (Racib.) Lister, Guide Brit. Mycet., ed. 3. 31. 1909.

KNOWN WORLD DISTRIBUTION: Europe, U.S.A., West Indies, Brazil, Argentina, S. Asia, Japan.

COSTA RICA: I (1), UCR-39 (TEX 1389), 4 VI 1963. On wood.

COMMENTS: A small collection consisting of about two dozen sporangia. The columella divides at the base of each sporangium into a number of strong branches and the whole configuration of the sporangia is typical for the species. C. lurida is distinguished from C. elegans by its columella which reaches into the sporangium and then divides. Whether this character is constant under various environmental conditions remains to be determined by experimental work when someone succeeds in growing these two species in artificial culture.

3. Comatricha subcaespitosa Peck, Ann. Rpt. N. Y. State Mus. 43:71. 1890.

KNOWN WORLD DISTRIBUTION: Eastern and Central U.S.A. and Canada, California, England, Switzerland, Dominica.

COSTA RICA: V (31), UCR-188 (TEX 1356), 18 VI 1964, on wood. Det. by Dr. G. W. Martin.

COMMENTS: Until Farr (1969) reported it from Dominica, this species was believed to be confined to the temperate regions. Our collection seems to be the second to be reported from the tropics.

4. Comatricha tenerrima (M. A. Curt.) G. Lister, Guide Brit. Mycet., ed. 4. 39. 1919.

KNOWN WORLD DISTRIBUTION: Europe, Quebec, U.S.A., Antigua, Brazil, Jamaica, Japan.

COSTA RICA: IV (El Roble), UCR-105 (TEX 1390), 30 VII 1963, on wood.

COMMENTS: The sporangia have shed most of their spores and are pale brown in color. They appear cylindrical to fusoid but not so much fusoid as in typical _C. tenerrima_. The capillitium, too, is not exactly typical, lacking the uniformity expected of this species, some of its branches being somewhat heavier than others. The stalks are long, from 2/3 to 3/4 the height of the sporophores. They are dark brown in color and appear fibrous at their origin from the hypothallus. Dr. Marie Farr concurs with our identification.

*5. _Comatricha typhoides_ (Bull.) Rost., in Lister, Mycet. 120. 1894.

KNOWN WORLD DISTRIBUTION: Cosmopolitan.

COSTA RICA: I (1), UCR-42 (TEX 1391), 4 VI 1963, UCR-77 (TEX 1392), 5 VII 1963; (8), UCR-256 (TEX 1395), 5 XI 1964. II (14), UCR-138 (TEX 1394), 17 VIII 1963. VII, Welden, p. 97. All on wood.

COMMENTS: The sporangia of UCR-42 are hard and aberrant for the most part, but the spores are typical. Spore markings of _C. typhoides_ appear to be remarkably constant even when sporangia are developed under adverse conditions as Wollman's (1966) experimental work has amply demonstrated. This makes this species particularly easy to recognize. No other _Comatricha_ has spores resembling those of _C. typhoides_. The delicate peridium is present on some sporangia in all specimens cited above.

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BOOK REVIEW

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FUNGI THAT DECAY PONDEROSA PINE, par Robert L. GILBERTSON, x + 197 p., 248 figs., 1974. The University of Arizona Press, Tucson, Arizona, US $ 9.50.

Le pin ponderosa (*Pinus ponderosa* Laws.) constitue l'espèce la plus largement répandue d'Amérique du Nord, de la Colombie britannique au Mexique. Il y fournit un très grande proportion de la production de bois d'oeuvre. La préservation d'une telle richesse naturelle exige une exacte connaissance des champignons destructeurs qui la menacent.

Des 228 espèces de Basidiomycètes (Tremellales, Aphyllophorales et quelques Agaricales) connus sur le pin ponderosa et qui font l'objet de cet ouvrage, 200 ont été observées en Arizona et au Mexique, tandis que certaines des 28 autres, reconnues ailleurs sur le pin, y ont été retrouvées sur d'autres hôtes. Chaque espèce est décrite avec précision et ses caractères microscopiques dessinés au trait.

Devant la richesse de la mycoflore du pin ponderosa, comprenant par example 90 corticiacées et 66 polyporacées, un manuel comme celui-ci contribuera certainement à l'identification plus précise de ces champignons.

INDEX TO FUNGOUS AND LICHEN TAXA

This index includes genera, infrageneric taxa, species, and infraspecific taxa. New taxa are in CAPITALS, and the pages where they are published are in *italics*. Lowe's monograph of *Tyromyces* is separately indexed (pp. 78-82), and these names are not indexed again here except for new taxa and their basionyms. The list of epithets on pp. 155-165 is also not indexed here.

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